JANUARY 2, 1937

ELECTRICAL WORLD

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JAN 6 1937

33d Annual Statistical Number

NO WARM WORDS of encouragement are needed to brighten the picture for the electrical industry. The hard, cold facts of statistical evidence presented within these pages reveal, better than anything else, the recovery, progress and achievement of 1936 and foretell the reasonable expectations for the new year—come what may. Beyond doubt 1937 will be a year of great prosperity for the entire electrical industry.

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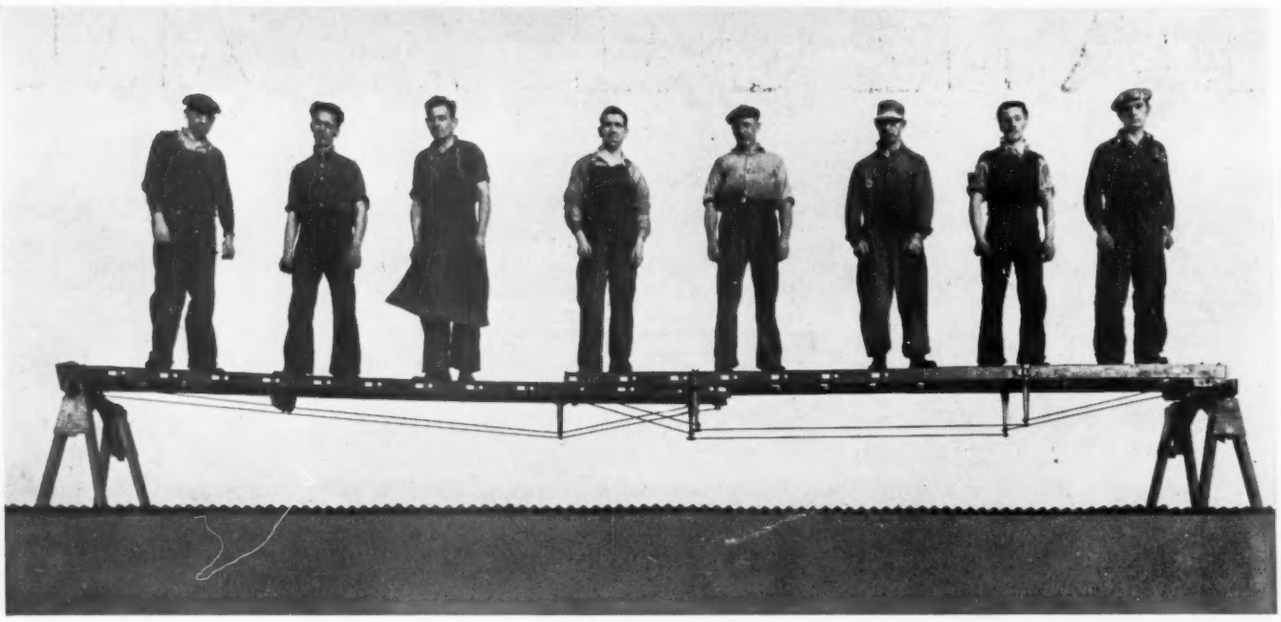

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ELECTRICAL WORLD

JANUARY 2, 1937

The Lesson of 1936

AS A YEAR CLOSES it is always well to sit back and view it as a whole to see what lesson it has taught us that can be used to chart the course for the new year. And in looking for that lesson, let us not make the mistake of looking at the details, some of which may have been aggravating and some of which may have been pleasing, but rather let us take a broad over-all perspective. The industry learned many things in 1936. It made certain engineering achievements which produced better efficiencies and it learned how to finance at lower cost, but the big lesson is the need for *selling* and *telling*.

Engineering has been counted upon very largely in the past to produce those economies of operation and construction practice which would offset rising costs. Engineering will continue to produce better efficiencies, but the savings that can be expected from this direction are no longer sufficient to overcome mounting taxes, salary rolls, and costs of supplies, as well as decreasing rates. Management as the steward for the investors' money must look in some other direction to produce additional revenue, and the answer of 1936, which is so eloquently demonstrated in the statistics that follow, is extensive and intensive, intelligent load building.

Here is a new job for management which current economic problems have made fundamental. In the old economic order, extension of production came first, to be followed by lower rates. In the new economic order, the reverse has happened and this has put a new value on selling. The lesson from 1936 is that selling must be planned—planned with respect to character of business, planned with respect to stability of load, planned with respect to its effect upon future developments, planned with respect to its earning power, planned with respect to its effect upon system capacity. It is requiring some new thinking with respect to customer and market analyses and careful, critical examination of the facts so revealed.

In other words, the electric light and power industry learned in 1936 that it must put its sales activities and policies to much the same test as manufacturers in competitive non-regulated industries. Where commercial thinking has held to this new concept, increased customer usage has resulted.

The other part of the 1936 lesson is the telling—the new term for customer and public relations. The continued bombardment of the public mind with propaganda on government and municipally owned power can, if unchallenged by the telling of the service story of private utilities, in time gradually destroy the public confidence in the electric light and power industry. And the telling can best be done through the manner in which the industry meets its customers. What does it profit a company to print convincing messages in the newspapers and elsewhere if a meter reader, or a lineman, or a sales clerk, or any of the other many kinds of employees who meet the public, can create dissatisfaction through carelessness, indifference, or plain cussedness? Tell it by the printed word, or the spoken voice over the radio—yes, by all means. But tell it also through the service of employees trained in service, courtesy and thoughtfulness.

As the statistics in this issue show, 1936 was a year of achievement for the electric light and power industry, but if it did nothing else than to give the industry the great lesson of selling and telling, it would still have been a year of great achievement.

OUTSTANDING FACTS

Figures are on electric light and power industry for the year's operations or as of the end of each year

	1929	1930	1931	1932	1933	1934	1935	*1936
CAPITAL invested ($1,000)	11,100,000	11,800,000	12,400,000	12,600,000	12,800,000	12,900,000	13,100,000	13,300,000
Securities sold ($1,000)	1,468,895	1,591,986	1,491,742	465,921	56,248	129,815	1,063,671	1,290,106
By investment houses ($1,000)	[3]1,315,459	[3]1,452,854	[3]1,341,742	[3]1,341,742	[3]55,873	[2]129,815	[2]1,063,671	[2]1,290,106
Direct to customers ($1,000)	153,436	139,132	150,000	18,000	375	.....	.....	.....
REVENUE, elec. serv. ($1,000)	2,105,900	2,151,150	2,125,110	1,979,990	1,906,110	1,980,460	2,073,841	2,231,500
From ult. consumers ($1,000)	1,938,520	1,990,955	1,975,944	1,832,596	1,773,416	1,837,046	1,921,077	2,071,500
Domestic ($1,000)	618,799	664,441	678,611	669,200	656,570	677,697	702,683	728,200
Small light and pwr. ($1,000)	555,640	575,598	564,524	528,861	499,684	511,682	538,394	587,000
Large light and pwr. ($1,000)	613,171	590,992	570,127	476,451	465,191	495,657	528,948	600,000
Munic. ltg. and misc. ($1,000)	98,646	107,841	114,045	113,952	109,462	107,446	104,561	106,760
Railways, railroads ($1,000)	52,264	52,083	48,637	44,132	42,809	44,564	46,491	49,540
Other sources ($1,000)	167,380	160,195	149,166	147,394	132,694	143,414	152,764	160,000
EXPENDITURES								
Additions, extensions ($1,000)	866,344	960,890	633,415	260,000	180,000	170,000	330,100	531,100
Operating, total[1] ($1,000)	934,890	946,180	913,910	[7]817,950	795,811	857,200	867,450	934,200
Salaries and wages ($1,000)	405,000	423,000	392,000	[7]323,880	292,000	316,000	330,000	359,000
Taxes ($1,000)	176,800	192,200	197,200	[7]205,151	216,300	246,300	252,460	273,560
ENERGY (1,000,000 kw.-hr.)								
Output, central stations	91,421	89,952	86,312	77,868	79,983	85,970	93,656	105,828
From fuel	59,031	59,388	57,742	45,991	47,533	53,808	56,067	68,737
From water power	32,390	30,562	28,570	31,877	32,450	32,162	37,589	37,091
Total; incl. imported and purch.	92,757	91,957	88,400	79,505	81,913	87,577	95,351	108,854
SYSTEMS, STATIONS								
Number of establishments	[8]2,801	[8]2,755	[8]2,596	[7]3,429	.....	.....	.....	.....
Commercial establishments	[8]1,480	[8]1,379	[8]1,308	[7]1,627	.....	.....	.....	.....
Municipal establishments	[8]1,321	[8]1,376	[8]1,288	[7]1,802	.....	.....	.....	.....
Companies generating	[8]1,699	[8]1,575	[8]1,686	[7]1,788	.....	.....	.....	.....
Companies purch. all energy	[8]1,102	[8]1,180	[8]910	[7]1,641	.....	.....	[8]809	.....
No. 100,000,000 kw.-hr. systems	137	142	142	138	137	.....	140	.....
Transmission (circuit miles)	[6]184,931	[6]200,171	[6]208,457	[6]208,097	.....	.....	.....	.....
Generating plants, all cent. sta.	4,250	[8]3,873	[8]3,746	[7]4,339	4,292	4,438	[8]3,615	.....
Commercial	3,190	2,863	.....	.....	.....	.....	2,734	.....
Municipal	1,060	1,010	.....	.....	.....	.....	881	.....
RATINGS								
Generator rating (kw.)	29,558,637	31,976,138	33,483,821	34,010,137	33,970,602	33,932,639	34,016,179	34,466,000
Prime movers (hp.)	41,551,800	44,747,000	47,112,000	[7]47,966,962	47,940,600	47,719,400	47,630,500	48,255,000
Steam engines, turbines (hp.)	29,512,000	31,540,000	32,250,000	[7]33,553,634	33,442,600	33,161,000	32,910,000	32,970,000
Water wheels (hp.)	11,439,000	12,540,000	14,155,000	[7]13,532,027	13,601,000	13,622,400	13,723,400	14,273,000
Internal comb. engines (hp.)	600,000	667,000	707,000	[7]881,301	897,600	936,000	997,100	1,012,000
FUEL CONSUMPTION								
Coal and coke (short tons)	41,406,000	39,702,000	35,690,336	27,589,000	28,039,000	30,942,000	32,243,000	38,357,000
Oil (bbl.)	9,740,000	8,950,000	7,898,629	7,269,000	9,446,000	10,076,000	11,112,000	13,565,000
Gas (million cu. ft.)	112,442	119,457	138,483	107,138	101,000	124,648	120,800	152,452
ENERGY DISPOSITION								
Sales, ult. users (mil. kw.-hr.)	75,294	74,906	71,902	63,764	65,754	70,782	77,555	89,775
Domestic	9,773	11,018	11,738	11,987	11,960	12,798	13,978	15,375
Small power and light	13,106	13,944	13,544	12,932	12,475	13,151	14,222	16,350
Large power and light	44,326	41,621	38,451	31,186	33,723	36,918	41,162	49,050
Municipal lighting and misc.	2,450	2,735	2,994	2,944	2,931	2,860	2,944	3,260
Railways and railroads	5,640	5,588	5,175	4,715	4,665	5,055	5,249	5,730
Company railway depts.	1,279	1,184	970	843	699	652	580	575
Company use and losses	16,184	15,867	15,528	14,898	15,460	16,143	17,217	18,504
CUSTOMERS								
Customers, total	24,147,183	24,555,732	24,489,770	24,149,300	24,295,515	24,808,537	25,312,802	26,028,050
Domestic service	19,967,154	20,331,551	20,151,247	19,849,963	20,004,098	20,484,232	21,019,012	21,648,299
Small light and power	3,598,115	3,628,653	3,724,013	3,687,636	3,697,324	3,727,478	3,710,771	3,800,202
Large light and pwr. and other	581,914	595,528	614,510	611,701	594,093	596,827	583,079	579,549
People in electric lighted homes	82,000,000	83,400,000	82,700,000	82,500,000	82,500,000	84,500,000	87,000,000	89,700,000
Per cent of total population	68.0	68.2	67.4	67.0	66.7	67.1	68.5	70.0
EMPLOYEES, total	289,000	298,000	282,000	244,573	232,000	247,000	248,000	266,500

* Estimated, generally on ten months' operations.

[1] Does not include interest, taxes, depreciation or sinking fund.

[2] Includes institutional investors.

[3] Includes rights.

[6] 11,000 volts or over.

[7] Census.

[8] Listed in Central Station Directory.

The Record

HERE in this issue is the annual audit of the electrical industry. For the first time in years the hard, cold figures of fact, unadorned by warm words of hopeful optimism, give undeniable evidence of a new prosperity. Yet good as 1936 turned out to be, there is every reason to believe that 1937 for the electrical industry will be much better. New records have been made in output and revenue. Taxes, wages and material costs are up and the average rate is lower, yet careful management and intelligent selling have combined to earn a higher net. The entire picture presents a fine record.

What are the facts?

Output: 105,828,000,000 kw.-hr.
Passes 100-billion mark for first time. Increase of 12 billion and gaining faster at close of year than at beginning. Industrial consumption finally breaks 1929 record and accounts for two-thirds of total gain.

Revenue: $2,231,500,000 gross.
Surpasses 1930, the previous high. Increase over 1935 equals 7.6%. Increase in net $62,633,000, or 3.3%. Average bill increases 7.8% for 15.8% greater usage. Average residential rate hits all-time low of 4.74 cents per kilowatt-hour.

Expenditures: $1,538,000,000.
Includes 330 million capital. Operating and maintenance increases 11% over 1935 to 934 million. Low operating ratio of 41.9%. Taxes up 21 millions to 273 millions—holds at 14%. Total for salaries and wages up 9%.

Customers: 26,028,050.
Gain of 715,250. Domestic customer increase of 574,000.

Capacity: 36,600,000 kw.
Added 606,858 kw. in 1936. To be added in 1937—1,272,930 kw. Also, 5,000 miles transmission lines and 2 million kva. of substations.

Budget: $635,434,000 for 1937.
Capital expenditures to increase 60% to over half a billion. Maintenance approximately the same as last year.

Financing: $1,290,106,000.
New capital, 45 millions. Fifty-two millions stock. Balance refinancing. All-time low yield.

Rural: 900,000 customers.
A gain of 109,000. To spend 48 millions more on lines in 1937.

Federal Power: $1,300,000,000 in process.
Appropriations to date slightly more than half ultimate cost. Fifty-one P.W.A. projects in litigation involve over fifty millions.

Equipment Sales: $1,190,000,000.
Gain over 1935 of 33%. Estimated increase in 1937 of 25% to bring total to a billion and a half.

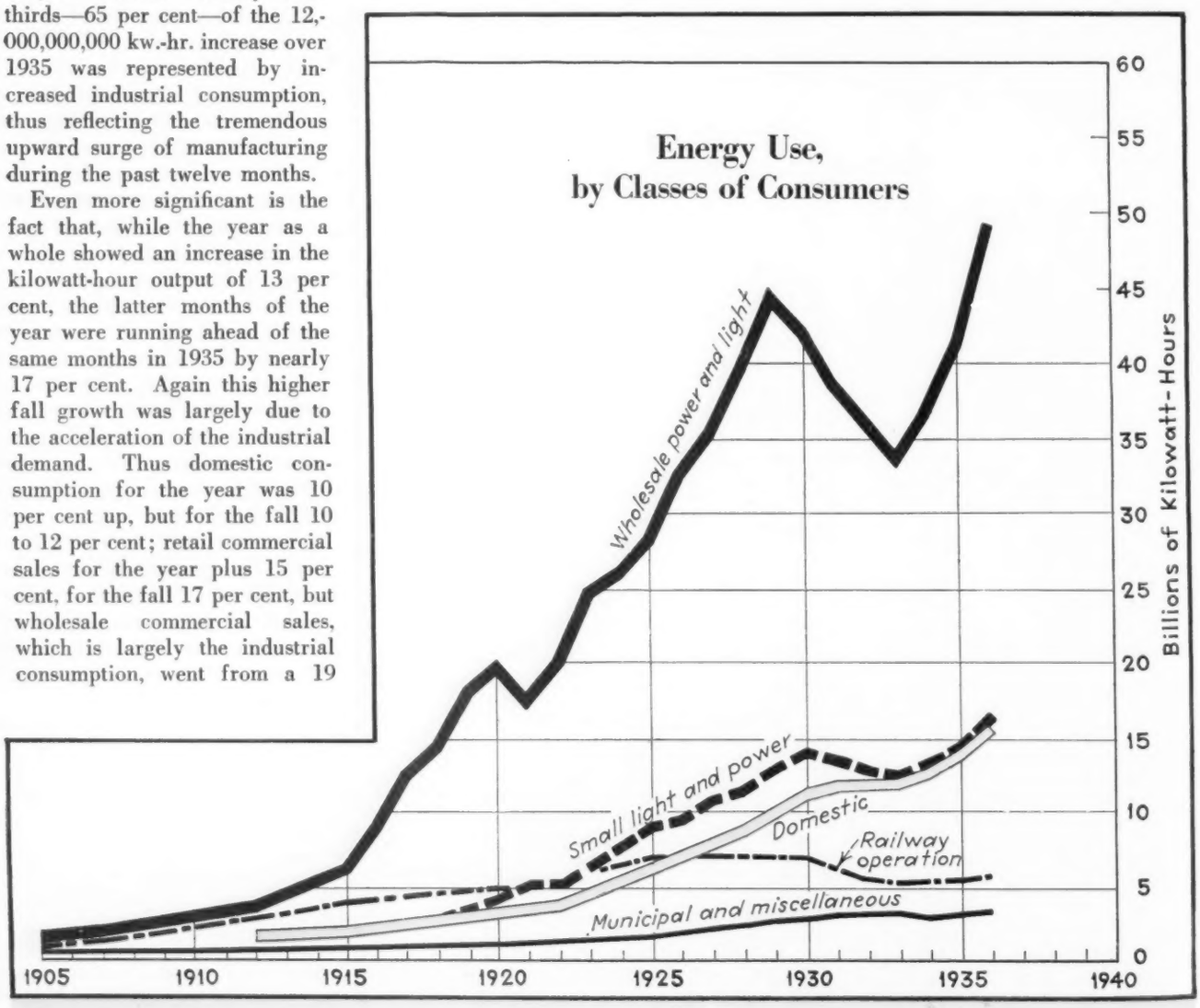
Energy Record of 105,828,000,000 Kw.-Hr.

Output passes hundred-billion mark for first time, registering 12 billion gain—Industrial consumption, passing 1929 for first time, accounts for two-thirds of increase—Domestic, now 57 per cent over 1929, shows effects of major appliance sales

FOR the first time the output of electrical energy generated by central stations has exceeded 100,000,000,000 kw.-hr., reaching in 1935 the record figure of 105,828,000,000 kw.-hr. Nearly two-thirds—65 per cent—of the 12,000,000,000 kw.-hr. increase over 1935 was represented by increased industrial consumption, thus reflecting the tremendous upward surge of manufacturing during the past twelve months.

Even more significant is the fact that, while the year as a whole showed an increase in the kilowatt-hour output of 13 per cent, the latter months of the year were running ahead of the same months in 1935 by nearly 17 per cent. Again this higher fall growth was largely due to the acceleration of the industrial demand. Thus domestic consumption for the year was 10 per cent up, but for the fall 10 to 12 per cent; retail commercial sales for the year plus 15 per cent, for the fall 17 per cent, but wholesale commercial sales, which is largely the industrial consumption, went from a 19 per cent gain for the year as a whole to 25 per cent for the fall.

The 1935 industrial sales curve disregarded the usual characteristics of coming to a peak in the late summer and then tapering off for the balance of the year. Instead, from February on, each month has shown a larger volume than the previous month. The effect has been to establish new peaks

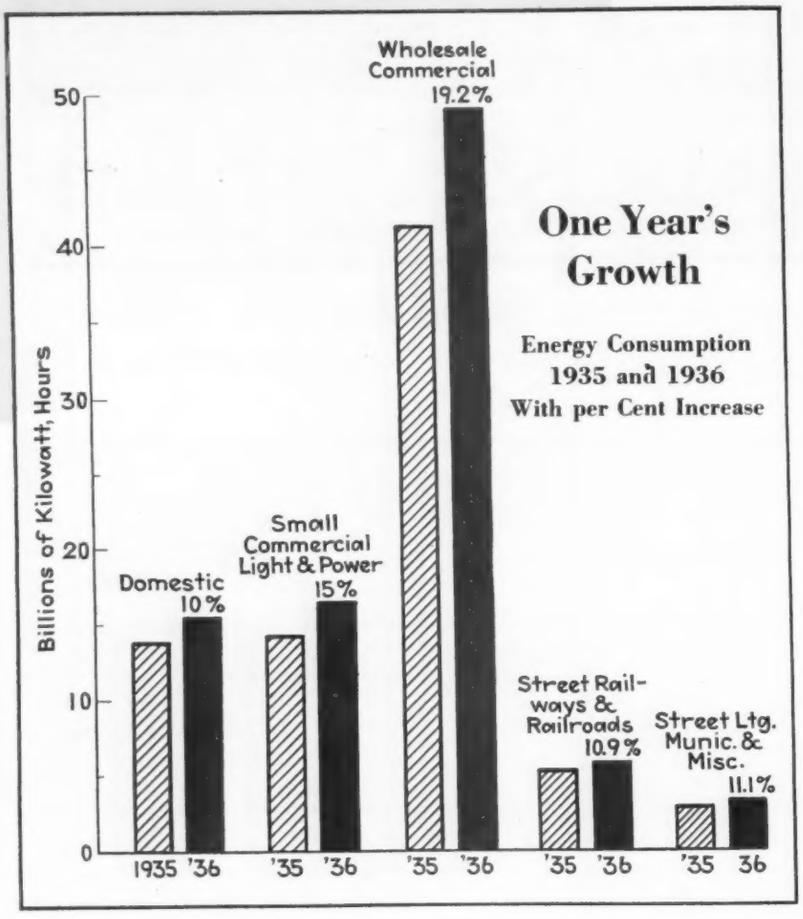


PROSPERITY RETURNS WITH ENERGY USE

	Total Energy in Industry	Total Energy in Homes
1919	18,200,000,000 kw.-hr.	2,300,000,000 kw.-hr.
1921	19,997,000,000 kw.-hr.	3,275,000,000 kw.-hr.
1923	24,665,000,000 kw.-hr.	4,420,000,000 kw.-hr.
1925	28,296,000,000 kw.-hr.	5,930,000,000 kw.-hr.
1927	35,263,000,000 kw.-hr.	7,676,000,000 kw.-hr.
1929	44,326,000,000 kw.-hr.	9,773,000,000 kw.-hr.
1936	49,050,000,000 kw.-hr.	15,375,000,000 kw.-hr.

While industrial production still lags some 13 per cent behind 1929, the use of electrical energy in industry is up by 11 per cent

The effect of major appliance promotion shows up in home consumption, which is ahead of 1929 by 57 per cent



and a decreasing margin between capacity and demand. That this situation must be translated into plant expansion is obvious. Other figures in this issue show the plans of the light and power industry, in spite of so many economic and political uncertainties, to meet these mounting demands with adequate facilities.

It used to be claimed that the energy output curve was a fairly accurate barometer of business conditions. Prior to 1929 there might have been some justification for that assumption, but in the past seven years that has not altogether been the case. The curve of industrial consumption (wholesale power and light) indicates this contention very clearly. From a peak in 1929, industrial production, according to the compilations of the Cleveland Trust Company, fell off 45 per cent to a low in 1932, and in 1936 was still 13 per cent below the top, Industrial energy consumption, on the other hand, dropped only 30 per cent from the peak, and in 1936 exceeded the 1929 high by nearly 11 per cent. In other words, advancement in the art in the form of new and improved applications plus the increasing mechanization of manufacturing processes prevents industrial consumption of energy any longer being solely an index of industrial production.

And even in the home, and the store, and the office building, the same condition prevails. In spite of unemployment and reduced wages, the residential consumption, except for a slight dip in 1933, in no year dropped below the previous year's total. Likewise, the consumption curve for stores and office buildings (retail commercial light and power) gives no indication of the severity of retail trade reduction and tenancy loss.

Of the three major classes of customers, the domestic is represented as showing the smallest rate of gain. This by itself might be misleading. One must look at the table "Distribution of Energy" to get the true picture. There it will be seen, as has already been pointed out, that the domestic consumption, having no loss to make up, has gone ahead to establish new records each year and, in fact, was nearly 60 per cent larger than the 1929 figure. The relative gains made by the three largest consumer groups in 1936 with respect to 1929 will help to complete this picture.

Domestic ..... 57 per cent
Commercial—wholesale...10.5 per cent
Commercial—retail .....17.2 per cent

An analysis of the relation of different classes of customers to the whole shows clearly the effect of residential load-building efforts. Prior to the depression residential usage accounted for approximately 12 per cent of the

Distribution of Central Station Energy—1926–1936

(Millions of Kilowatt-Hours)

Year	Generated In Central Stations*	Distributed to Ultimate Consumers								Losses	Company Use		Total Including Purchased Energy
		Total	Domestic	Com'l Light and Power		Municipal Street Lighting	Electric Railways	Electrified Railroads	Municipal and Miscel.		Railway	Other	
				Retail	Wholesale								
1926	69,158	56,089	6,827	9,485	32,615	1,589	4,951	426	196	11,834	1,530	1,023	70,476
1927	74,686	61,251	7,676	10,766	35,263	1,741	5,039	504	262	12,659	1,348	1,111	76,369
1928	82,927	66,988	8,619	11,692	38,903	1,911	4,991	560	312	13,842	1,330	1,235	83,395
1929	91,421	75,294	9,773	13,106	44,326	2,038	5,049	590	412	14,983	1,279	1,201	92,757
1930	89,952	74,906	11,018	13,944	41,621	2,227	4,997	591	508	14,561	1,184	1,306	91,957
1931	86,312	71,902	11,738	13,544	38,451	2,320	4,549	626	664	14,162	970	1,366	88,400
1932	77,868	63,764	11,987	12,932	31,186	2,364	4,175	540	580	13,678	843	1,220	79,505
1933	79,983	65,754	11,960	12,475	33,723	2,213	4,004	661	718	14,256	699	1,204	81,913
1934	85,970	70,782	12,798	13,151	36,919	2,203	4,352	703	656	14,782	652	1,361	87,577
1935	93,656	77,555	13,978	14,222	41,162	2,340	4,414	835	604	15,866	580	1,351	95,351
1936†	105,828	89,775	15,375	16,350	49,050	2,425	4,575	1,155	845	17,146	575	1,358	108,854

* Courtesy U. S. Geological Survey with deductions for plants not considered as central stations for light and power. † Estimated on ten months' operations.

Energy Sold to Ultimate Customers

(Millions of Kw.-Hr.)

Year	Industrial	Commercial	Domestic
1912*	3,254	1,754	818
1917*	12,560	2,970	1,560
1922*	20,620	5,900	3,660
1927	35,263	10,766	7,676
1928	38,903	11,692	8,619
1929	44,326	13,106	9,773
1930	41,621	13,944	11,018
1931	38,451	13,544	11,738
1932	31,186	12,932	11,987
1933	33,723	12,475	11,960
1934	36,918	13,151	12,798
1935	41,162	14,221	13,978
1936	49,050	16,350	15,375

* Allocation estimated on basis of best available information

energy sales. For the last four years it has been over 17 per cent. Retail commercial light and power now accounts for more than 18 per cent, where previously it was between 16 and 17 per cent. With both of these classes of customers, which represent the steady backlog of the business, now absorbing over 36 per cent of the total, where ten years ago it was only 28 per cent, a decided improvement has been made in the economic stability of the industry.

Of course, if industrial consumption continues to show such tremendous gains, this improvement in balance will be lost, unless air conditioning, water heating, electric cooking and rural electrification can be sold in sufficiently large quantities to accelerate materially the consumption by the non-industrial class of customers.

Total energy sales rose to 89,775,000,000 kw.-hr. in 1936, the increase of more than 12,000,000,000 kw.-hr. far exceeding the sales increase in any of the boom years. Industrial consumption at 49,000,000,000 kw.-hr. accounted for nearly 55 per cent of the total; next came retail commercial sales with 16⅓ billion, or 18.2 per cent, and then domestic at 15⅓ billion, or 17.1 per cent. Railways and railroads with 5¾ billions took a 6.4 per cent jump and municipalities and miscellaneous 3¼ billion, or 3.6 per cent.

The discrepancy between energy generated and kilowatt-hours sold is very largely due to losses, which in 1936 amounted to 15.75 per cent of all the energy distributed. This, incidentally, is the lowest loss percentage yet recorded for any one year. If the 1935 figure had applied to last year the losses would have been larger by a million kilowatt-hours.

A study of the chart of monthly output figures reveals retail commercial sales as once more outdistancing residential sales. For a period of three years previously they had been running neck and neck. Store modernization, involving higher concentration of lighting and increasing office rentals, undoubtedly accounts for much of this gain. The data are not sufficiently segregated to show the effect of air conditioning upon retail commercial energy sales, although it might be noted that the seasonal low in 1936 was in March and that the summer usage gained month by month. Certainly this load is destined to place the retail commercial customer group in a higher relative position upon the chart of energy consumption.

Ranges, water heaters and refrigerators are flattening out the summer dip in the domestic load curve. This should be much more pronounced in the next two or three years in spite of the definite trend toward higher lighting intensities in the home.

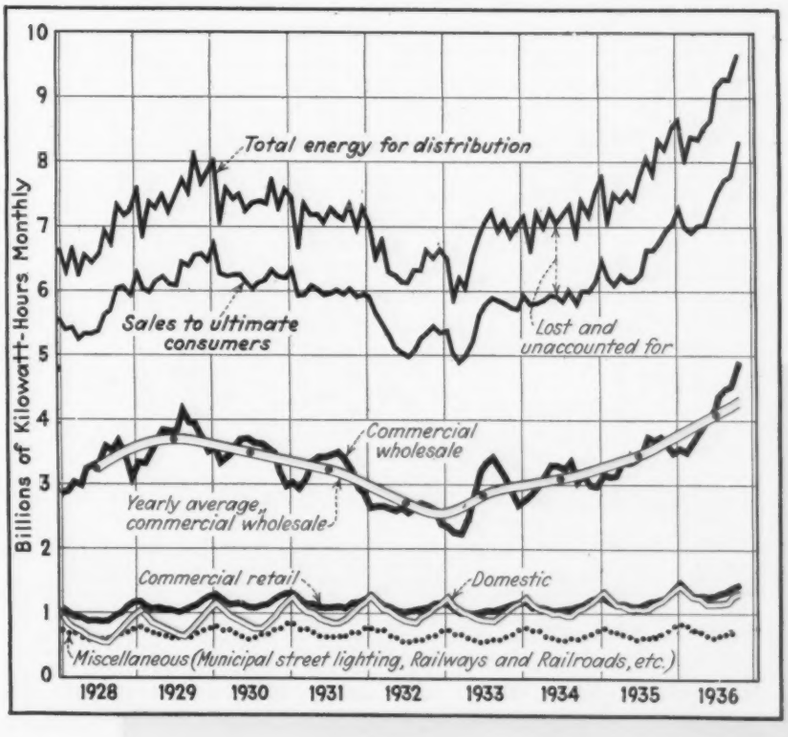
Municipal street lighting sales, though only slightly higher last year, were sufficient to establish a new peak for this class of service. However, the promotion now being directed toward improved street and highway lighting to decrease the number of driving accidents should show a marked improvement in street lighting sales.

Electric railway sales, some 3½ per cent higher, had recovered to 1931 levels, but still are nearly 10 per cent behind 1929. The trackless trolley is just beginning to show its influence in increasing transportation energy. Electrified railroad sales, on the other hand, though only 1¼ per cent of the total, were up nearly 40 per cent, showing the largest kilowatt-hour increase in any single year.

It is interesting to note that while the energy sales were increasing by approximately 16 per cent, the bill for this energy was higher by only 7.6 per cent. Is this not an excellent demonstration of the industry's economic philosophy?

In the face of rising taxes and other costs, together with the vast number of rate reductions, this sales achievement is a fine tribute to utility management.

Monthly Energy Sales in All Classes of Service Register Seasonal Changes and Rising Tide of Consumption



Gross Revenues Mount to $2,231,500,000

Record-Breaking Total Surpasses Previous High Established in 1930 — Usage Increased 15.8 per Cent, but Bill Increased Only 7.8 per Cent — Three Major Classifications Reach New High Levels

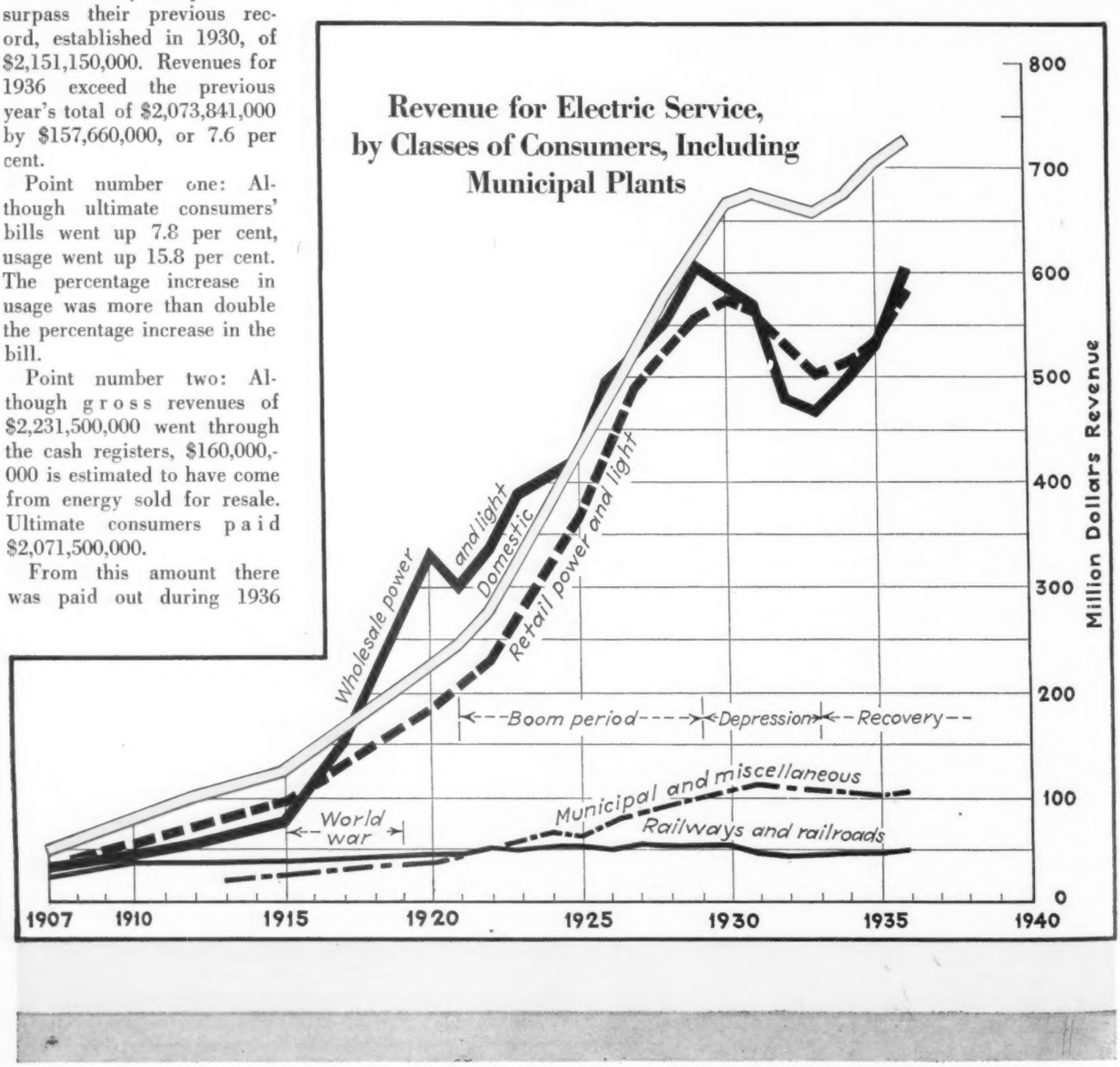
DURING 1936 gross revenues for electric service amounted to the record-breaking total of $2,231,500,000. It has taken six years for the utility companies to surpass their previous record, established in 1930, of $2,151,150,000. Revenues for 1936 exceed the previous year's total of $2,073,841,000 by $157,660,000, or 7.6 per cent.

Point number one: Although ultimate consumers' bills went up 7.8 per cent, usage went up 15.8 per cent. The percentage increase in usage was more than double the percentage increase in the bill.

Point number two: Although gross revenues of $2,231,500,000 went through the cash registers, $160,000,000 is estimated to have come from energy sold for resale. Ultimate consumers paid $2,071,500,000.

From this amount there was paid out during 1936 $934,200,000 for operating expenses and maintenance and a tax bill of approximately $273,500,000, leaving a net before depreciation and before fixed charges totaling $1,023,200,000.

The corresponding net and gross for 1935 were $953,931,000 and $2,073,841,000, respectively. Thus,



ELECTRIC POWER IS CHEAP POWER

	Industrial Revenue	Domestic Revenue
1920	$377,500,000 1.89 cents per kw.-hr.	$223,500,000 7.56 cents per kw.-hr.
1923	$393,000,000 1.66 cents per kw.-hr.	$323,000,000 7.3 cents per kw.-hr.
1926	$488,915,000 1.50 cents per kw.-hr.	$478,182,000 7.00 cents per kw.-hr.
1929	$613,172,000 1.38 cents per kw.-hr.	$618,799,000 6.30 cents per kw.-hr.
1932	$476,450,000 1.53 cents per kw.-hr.	$669,200,000 5.59 cents per kw.-hr.
1935	$532,500,000 1.29 cents per kw.-hr.	$709,200,000 5.07 cents per kw.-hr.
1936	$600,000,000 1.22 cents per kw-hr.	$728,200,000 4.73 cents per kw-hr.

Since 1920 industrial energy has increased 2.45 times and its price decreased 35.8%. Domestic energy use has increased 5.2 times and its price decreased 37.4%. Even since 1932 the country's electric bill has been only 13 per cent more for 41 per cent more energy use.

while the gross increased $157,659,000, the net before depreciation and fixed charges rose only $69,269,000.

Point number three: To complete the over-all picture of revenue, it may be noted that the grand total of 89,775,000,000 kw.-hr. was sold for a gross figure of $2,071,500,000. The over-all average rate is thus calculated to be 2.30 cents.

The corresponding figure was 2.50 cents in 1935, 2.59 cents in 1934. The industry continues to render service at ever lower prices to the user.

So much for the general picture of revenue. We turn now to the 1936 record of what was accomplished in the field of domestic service. All such data include urban and rural customers, and include also non-irrigated farms. To include farms using electric power for irrigation would tend to distort the record.

Domestic customers purchased 15,375,000,000 kw.-hr. during 1936, another record-breaking total, and one which exceeded the 1935 record of 13,978,000,000 kw.-hr. by 10 per cent.

Although usage increased 10 per cent, the total bill for domestic service increased only 3.64 per cent. The revenue figures are $728,200,000 for 1936, $702,683,000 for 1935.

As recently as 1930 the householders of the nation paid an average rate of 6.03 cents per kilowatt-hour. In 1934 they paid 5.40 cents per kilowatt-hour and in 1935 5.03 cents. For 1936 the average rate dropped to an all-time low of 4.74 cents.

No encomium is needed for that figure; it tells its own story of American initiative, American brains and of an American concept of service to the people.

As recently as 1930 the people paid a price 27 per cent higher for their domestic electric service. And for those who refer to 1926 as a normal year, the present average domestic rate is approximately 33 per cent lower.

Finally, the domestic customer used more electric service this year than ever before. The national average now is 720 kw.-hr., compared to 673 kw.-hr. a year ago, and the average domestic bill is only 43 cents more—$34.28 compared to $33.85 a year ago.

Commercial revenues at last eclipse 1930 totals

Commercial *retail* revenues for 1936 are $587,000,000 and for the first time exceed the 1930 record of $575,598,000. They exceed the 1935 figure of $538,394,000 by 9 per cent.

Although commercial retail customers' billings increased 9 per cent, they used 15 per cent more energy. The energy figures: 16,350,000,000 kw.-hr. in 1936; 14,222,000,000 kw.-hr. in 1935.

Here, again, the average price per kilowatt-hour was dropped another notch, from 3.78 cents in 1935 to 3.58 cents in 1936.

One more comparison may be of interest, that of 1936 against 1930. Revenues are up 9 per cent to $587,000,000, usage is up 17 per cent to 16,350,000,000 kw.-hr., and the average rate is *down* 13 per cent (4.13 cents vs. 3.58 cents per kw.-hr.).

Commercial *wholesale* revenues for 1936 are approximately $600,000,000. They, too, are finally on a par with the 1930 figure of $590,992,000 and show an increase over 1935 of $71,052,000, or 13.4 per cent.

Here again bills which increased 13.4 per cent were more than offset by increased usage. This classification used 49,050,000,000 kw.-hr. in 1936, an increase of 19.2 per cent and an all-time peak. The average rate earned in 1936 is 1.22 cents.

Granting that many of these customers are now for the first time

Revenue from Ultimate Consumers, by Regions

(In Millions of Dollars)

	1931	1932*	1933	1934	1935	1936[1]
United States	**1,976**	**1,821**	**1,773**	**1,837**	**1,921**	**2,072**
New England	162	155	154	158	164	174
Middle Atlantic	579	541	526	544	560	585
East No. Central	458	413	400	416	445	480
West No. Central	168	155	150	158	162	177
South Atlantic	174	161	160	161	169	195
East So. Central	72	65	63	66	70	77
West So. Central	110	101	97	101	105	115
Mountain	59	52	51	53	57	63
Pacific	194	177	172	180	189	205

* U. S. Census of Electric Light and Power
[1] Estimated on ten months' operations.

Revenue of the Electric Light and Power Industry by Sources—1926–1936

Year	(Thousands of Dollars) Revenue from Ultimate Consumers[1]								Other Electric Service[4]	Total Revenue for Electric Service[4]
	Total	Domestic	Com'l Light and Power		Municipal Street Lighting	Electric Railways	Electrified Railroads	Municipal and Misc.		
			Retail	Wholesale						
1926	1,520,159	478,182	427,407	488,915	68,023	47,618	4,373	5,641	101,391	1,621,550
1927	1,661,032	523,689	482,136	519,074	77,248	47,965	5,172	5,748	141,623	1,802,655
1928	1,784,309	571,620	519,957	549,989	83,024	46,489	5,560	7,670	157,646	1,941,955
1929	1,938,520	618,799	555,640	613,172	88,323	46,277	5,986	10,323	167,380	2,105,900
1930	1,990,955	664,441	575,598	590,992	95,458	46,068	6,015	12,383	160,195	2,151,150
1931	1,975,944	678,611	564,524	570,127	99,299	41,912	6,725	14,746	149,166	2,125,110
1932[2]	1,832,596	669,200	528,861	476,450	100,919	38,311	5,821	13,034	147,394	1,979,990
1933	1,773,416	656,570	499,684	465,191	94,270	36,359	6,550	14,792	132,694	1,906,110
1934	1,837,046	677,697	511,682	495,657	92,984	37,838	6,726	14,461	143,414	1,980,460
1935	1,921,077	702,683	538,394	528,948	91,822	38,725	7,766	12,739	152,764	2,073,841
1936[3]	2,071,500	728,200	587,000	600,000	90,375	39,575	9,965	16,385	160,000	2,231,500

[1] Edison Electric Institute. [2] For consistency with other years E. E. I. figures are given for census year 1932. Census total is $1,975,303,955; to ultimate consumers $1,821,105,524. [3] Estimated on the basis of ten months' operations. [4] Electrical World. Includes sales for resale, involving some duplication.

using power purchased from a central station, this usage indicates the improvement which has taken place in industry within twelve months, as well as modernization and mechanization. Purchasing nearly 20 per cent more kilowatt-hours than a year ago, these customers bought only 31,000,000,000 kw.-hr. in 1932, 34,000,000,000 in 1933, 37,000,000,000 in 1934, 41,000,000,000 in 1935. In 1936, 49,000,000,000.

Miscellaneous classes

The remaining classifications—municipal street lighting, electric railways, electrified railroads, and municipal and miscellaneous—present on the whole an improved picture.

Municipal street lighting revenues actually declined, from $91,822,000 in 1935 to the current total of $90,375,000, while kilowatt-hours sold in 1936 total 2,425,000,000, compared to 2,340,000,000 kw.-hr. used during 1935.

On the other hand, revenue from electrified steam railroads increased 28.6 per cent to $9,965,000; municipal and miscellaneous likewise 28.6 per cent to $16,385,000, and electric railway 2.2 per cent to $39,575,000.

The revenues in 1936 from the four classes of business noted above amounted to the respectable total of $156,300,000. The average rates at which these classes of business were served tell a story all their own.

The municipal street lighting rate, for example, was 3.73 cents, the highest of the group. Although consumption went up 3.6 per cent, street lighting revenues declined by $1,400,000, or about 1.5 per cent. Here we have an average rate dropping with little, if any, diminution in the collateral services required from the company by the municipality, such as patrolling street lighting circuits, replacements and maintenance, which involve continuing expenses aside from the cost of generating the energy consumed.

Steam railroads buy for 0.86 cent

The energy consumed by electrified steam railroads increased sharply by 38.3 per cent. Revenues went up in 1936, were 28.6 per cent over 1935. But the average rate for this class of service in 1936 was 0.86 cent.

The electric railways contributed $39,575,000 to gross revenues, but they paid an average rate of only 0.87 cent per kilowatt-hour.

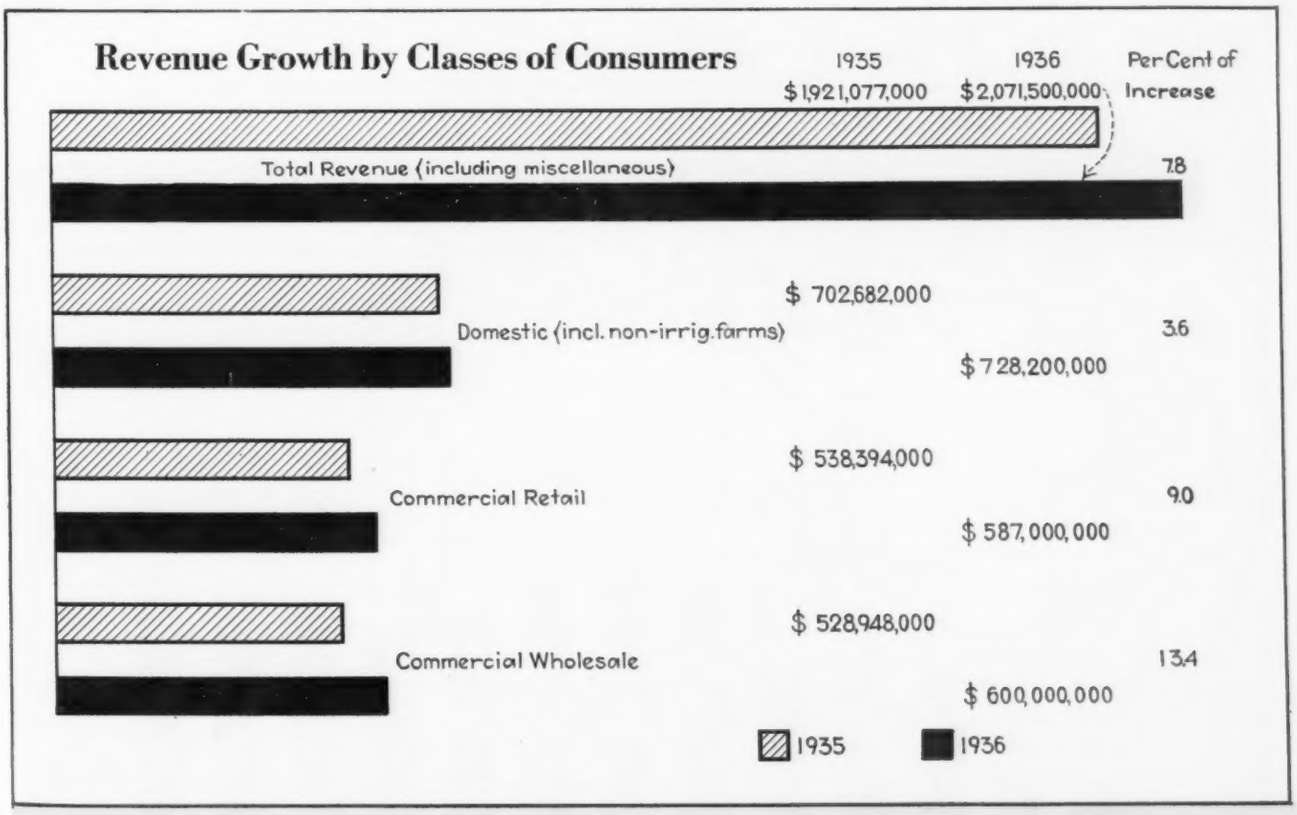
Domestic increases pose a question

On the preceding page it was pointed out that the average domestic usage increased from 673 kw.-hr. to 720 kw.-hr. and the average domestic bill from $33.85 to $34.28.

There may be food for thought in the observation that "the average customer," non-existent though he is, purchased 47 more kilowatt-hours in 1936 and paid only 43 cents more for them. One way to look at the proposition would be to say that the new domestic load added this year, on the whole brought in only 9.15 mills per kilowatt-hour.

This statement catches attention, for, in the words of Mr. Ripley, "believe it or not" it refers to domestic service.

It poses the fanciful question as to whether there is an invisible clause on the rate schedule of the domestic customer reading: "All excess over the 1935 annual usage, 9.15 mills."



Utility Outlay Amounts to $1,538,000,000

Low Operating Ratio Shows Management Efficiency— Payrolls Are Up Too — Taxes Hold Peak Level — New Construction Took Approximately One-Third Billion

CONSIDERABLY more than a billion and a half dollars, $1,538,000,000, in fact, were spent by the electric utility industry, private and municipal, during the year 1936. Steadily rising consumption of energy and the confidence it reinspired has thus boosted the past year's expenditures by more than 11 per cent over the preceding 1935.

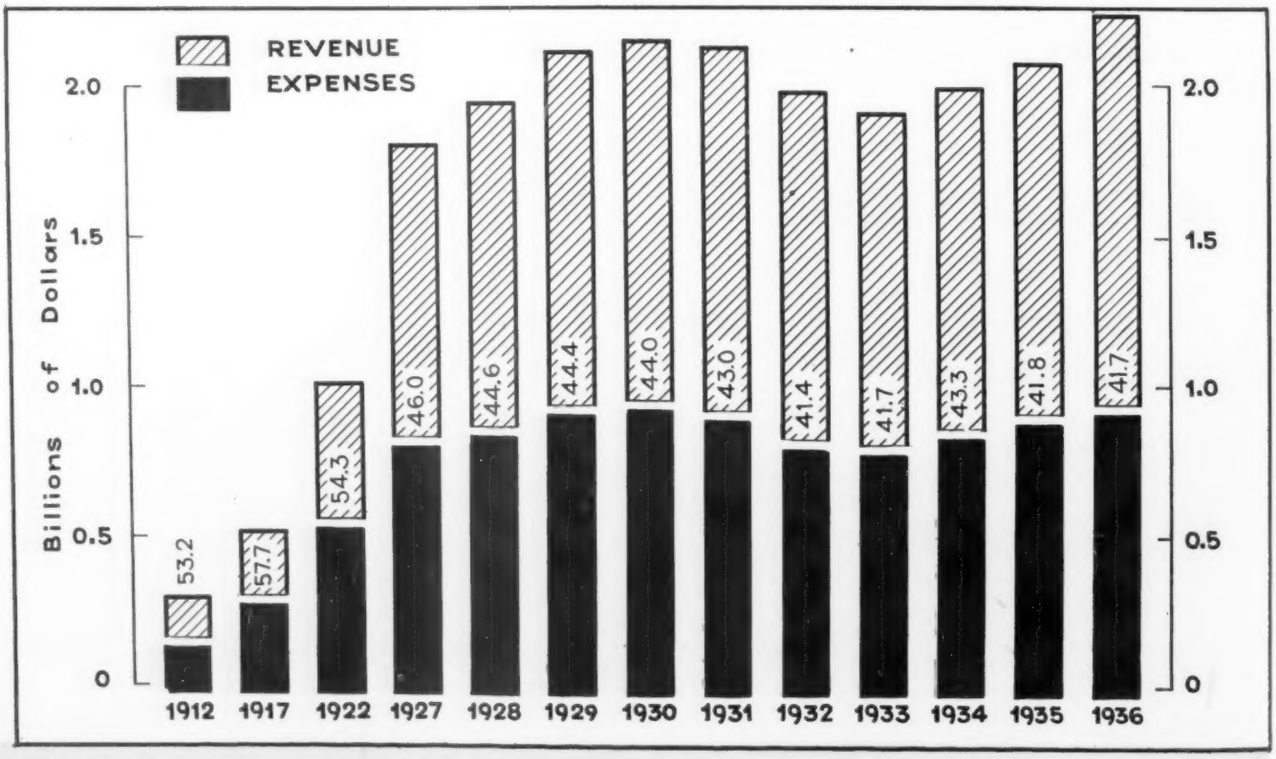
Taxes took the same high toll as in 1935, namely, 14 per cent of the gross revenue of the commercial companies. Employees drew in salaries and wages an amount greater than the 1935 figure by about 9 per cent.

It was, however. new construction outlays which engaged in the largest spurt. Building new lines and stations and other facilities entailed disbursements of $330,000,000 last year, against the low figure of $170,000,000 in 1934. That constitutes a jump of 95 per cent for the interval. Also, that this is merely a first step in the revival of activity in the whole electrical industry can be seen from the announced budgets for 1937 (page 82). There it is shown that the recent increase of 36 per cent is destined to be greatly outdone by the increase of 50 per cent of 1937 over 1936.

Operating and maintenance expenses kept pace in general with output and revenue and in doing so approached the all-time high of 1930. The 1936 outlay of $934,200,000 was practically the same as the 1929 boom year value for operating and maintenance expenditures. Though a year of drought and of flood, there was an

Revenue and Operating Expenses

Commercial and municipal establishments combined. Revenue and expenditures include intercompany sales. Expenses include maintenance, but not taxes or depreciation. Figures on bars show operating ratio in per cent



Comparison of Revenue, Expenses and Taxes

Entire Industry, Including Municipals

(Thousands of Dollars)

Year	Total Revenue for Electric Service	Operating and Maintenance Expenses (ex. Taxes)	‡Taxes
1912 *	237,139	152,629	13,147
1917 *	502,060	289,912	30,063
1922 *	1,020,329	553,068	73,772
1927 *	1,802,655	828,168	151,600
1928	1,941,955	866,350	167,700
1929	2,105,900	934,890	176,800
1930	2,151,110	946,180	192,200
1931	2,125,110	913,910	197,200
1932 *	1,975,304	817,956	205,151
1933	1,906,110	795,811	216,300
1934	1,980,460	857,200	246,500
1935	2,073,841	867,450	252,460
1936 †	2,231,500	934,200	273,560

Note.—Intercompany transactions are included in both revenue and operating expenses.

* Census. Expenses and taxes in 1927 adjusted to include small municipals omitted from census as to those items.

† Estimated on ten months operations.

‡ Taxes for non-census years 1928–1931 based on chart in E. E. I. Stat. Bul. No. 2; for 1933 and 1934 as estimated by E. E. I.

▼ ▼ ▼

all-time record of hydro-electric output. Moreover, the fuel consumed was greater than in 1935 and more money went for that purpose. Besides, there is a broad range of supplies and equipment rehabilitation and replacement that increases in volume when station and system activity rise, and especially when the rising revenues lessen executive caution in favor of more liberality in necessary spending.

People who are employed by utilities, private and municipal, were more in number and they drew more in wages and salaries in 1936. That item, amounting to $359,000,000, constituted 38.4 per cent of the entire $934,200,000 spent for keeping the systems running. It was up about 9 per cent, whereas the number of employees increased from 248,000 to an estimated 266,500 for the year, or 7.5 per cent. Assuming a gradual increase of staff during the year, it is thus evident that an average of 4 per cent more employees drew 9 per cent more in wages and salaries. The difference between these two percentages represents salary and wage adjustments similar to those being applied throughout industry.

All the foregoing pertains to the utilities, whether privately or municipally owned and operated. The federal program is detailed in another article in this issue. To get a true picture of the spending for electrical facilities and for electrical supplies and services, it is necessary to combine the data of the present article with those embraced in the article on federal commitments on page 98.

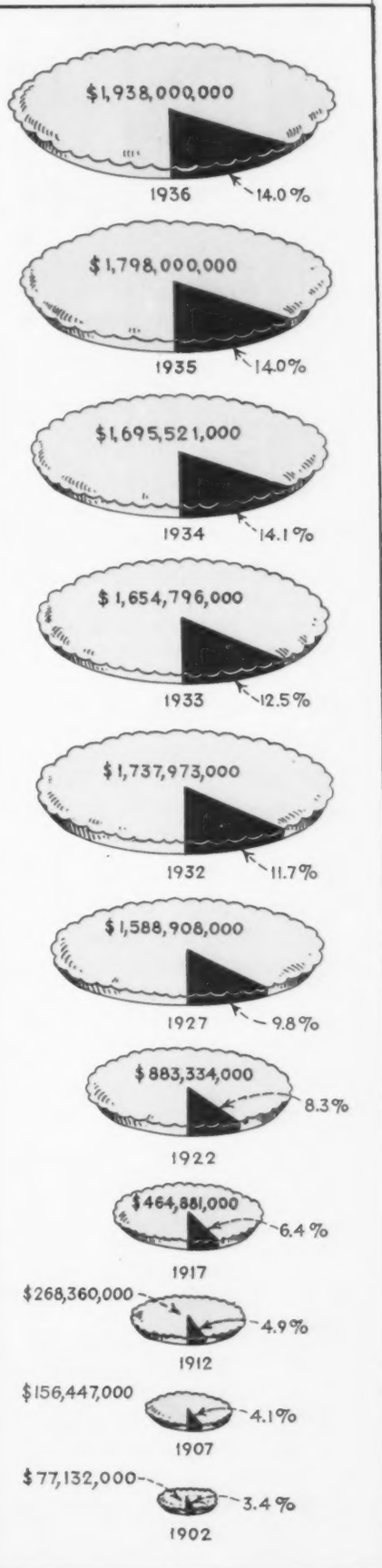
Any discussion of the tax burden on utilities must necessarily be confined to the commercial companies. Thus, the privately owned utilities during the year 1936 took in $1,938,000,000 in gross operating revenue. This is $140,000,000 higher than they collected in 1935, so the $21,000,000 increase in the tax bill (from $252,460,000 in 1935 to $273,560,000 in 1936) leaves the tax ratio practically unchanged. Thirty-five years ago the electric utilities paid taxes which amounted to 3.44 cents for each dollar of gross operating revenue. This percentage has climbed steadily and for three years it has clung to the 14 per cent level. Electric utilities are definitely adjuncts of the tax collectors' offices in that they pass on to governmental treasuries one dollar for every seven dollars that they collect from their patrons.

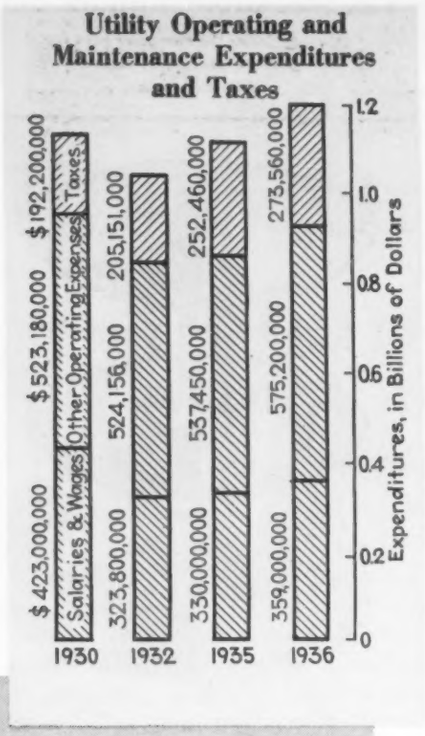
One word of caution should be injected here for the sake of consistency. It is not permissible to subtract the $1,938,000,000 gross operating revenue of the commercial companies from the $2,231,500,000 received as gross revenue by the whole electric utility industry (private and municipal) and credit the difference ($293,000,000) as receipts of the municipal systems. The reason is that the figure for the composite industry necessarily embraces some items of intercompany transactions involving resale before ultimate consumption takes place. These revenue items cannot safely be omitted, however, because they involve expense items which cannot readily be segregated. Actually, the revenue of the municipal plants is of the order of $135,000,000, leaving some $158,000,000 to represent intercompany transactions.

Utility spending of over a billion and a half dollars is a sizable factor in the national economic picture as measured in terms of dollar velocity. These expenditures filter through a multiplicity of channels. Nearly a fifth goes directly to employees as pay. For fuel, the utilities are paying

Tax Slice Grows With the Pie

Of every dollar the consumer pays for electrical energy, 14 cents goes into taxes





out about 10 per cent of what they take in. Thus, in 1935 the money spent for fuel was 40 per cent more than in 1932, and that means that coal miners in 1935 got a respectable part of the $39,000,000 that had not been spent for fuel in 1932. The fuel outlay of 1936 is not available, but it is almost certainly more than in 1935. The rise in expenditure for other operating and maintenance costs than labor and fuel was more moderate, a 10 per cent increase to $365,000,000. Even the additional $21,000,000 pumped into tax coffers in 1936 above the 1935 amount finds its way sooner or later into circulation.

However, one form of disbursement has slumped. It affects those who have a saved dollar invested in the utility industry. Dividend and bond interest figures are only available as estimates for 1936. In 1935 the sum allocated to return to investors of all descriptions and for amortization was practically $600,000,000 on their thirteen-billion-dollar investment in the industry. That was nearly 30 per cent less than the $841,000,000 of 1932. Increase in and resumption of dividends has probably not been enough to more than offset the decreased interest payments occasioned by the refunding at lower interest rates, the extent of which can be seen on page 78. It appears, therefore, that the money out of utility revenues put back into circulation through investor channels is still approximately a quarter less than it was four years ago. Meanwhile, money put back through wage-earner channels—directly as employee salaries, indirectly as purchases of supplies, indirectly as new construction outlays, and indirectly as tax money—accounts for the 11 per cent increase in over-all expenditure. Veritably, the utilities have been geared into the current disposition of government to redistribute wealth in such manner that an enhanced portion goes to those who earn and spend.

Operating costs and taxes have increased

The changing pattern of dispersal of the money collected from electric utility patrons is vividly portrayed in the full-page chart on the facing page. Operating costs and taxes are manifestly the items which have swollen in the last three years. Interest, amortization and dividends to investors are the items which have shrunk—in combination they had decreased by 29 per cent by the close of 1935 and there was little resumption indicated for 1936.

Efficiency of management is a matter of interest in view of the adjustments imposed upon the industry by government, by the depression and by the trend toward decentralized administration within the industry. The operating ratio is a quick index of such efficiency and it is interesting to observe the trend. From present data it appears lower (41.9 per cent) in 1936 than in any of the last 25 years except 1932 and 1933, the years of most dismal outlook. In 1932 it was 41.3 per cent and in 1933 it was 41.8 per cent. Twenty-five years ago the electric utility industry paid out 65 per cent of its receipts for operation and maintenance. That ratio has since been steadily whittled down until it represents only two-thirds as great a fraction of the intake. For ten years it has been down to 45 or less per cent. It has had to be to meet rising taxes and the need for liquidity to provide funds for accelerated rural and other line building and a bit in the category of stations. That the present figure is lower than the 43 per cent ratio for 1935 is primarily attributable to the 8 per cent spurt in gross revenue arising from an even larger spurt in consumption. The expenditures have been held down, but there are definite signs that caution is giving way to foresighted spending.

Revenue and Taxes

Commercial Companies Only

Compiled by Edison Electric Institute

Year	Gross Operating Revenue* (Thousands of Dollars)	Taxes (Thousands of Dollars)	Ratio Tax./Rev (Per Cent)
1902	77,132	2,655	3.44
1907	156,447	6,346	4.06
1912	268,360	13,117	4.89
1917	464,881	29,897	6.43
1922	883,334	73,128	8.28
1927	1,588,908	150,253	9.46
1932	1,737,973	203,858	11.73
1933 †	1,654,766	206,989	12.5
1934 †	1,695,521	239,773	14.1
1935 †	1,798,000	251,158	14.0
1936 ‡	1,938,000	272,258	14.0

Data from U. S. Census, except last four years.

* Includes revenue from ultimate consumers, from sales to municipal plants for "resale" and miscellaneous operating expenses, but not sales for resale to other light and power companies.

† From F. P. C. Rate Series No. 5, "Base Revenue" excluding sales for resale.

‡ Estimated on ten months' operations.— ELECTRICAL WORLD.

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Salaries and Wages

Commercial and Municipal Establishments

Year	Number of Employees			Salaries and Wages (Thous.)
	Comm'l	Munic.	Total	
1902 *	26,909	3,417	30,326	$20,647
1907 *	42,066	5,566	47,632	35,420
1912 *	71,395	7,940	79,335	61,162
1917 *	94,679	10,862	105,541	95,242
1922 *	136,105	14,657	150,762	212,433
1927 *	234,747	16,273	251,020	390,000 †
1928	.....	.....	265,000	.....
1929	.....	.....	289,000	405,000
1930	.....	.....	298,000	423,000
1931	.....	.....	282,000	392,000
1932 *	225,557	19,016	244,573	323,880
1933	.....	.....	232,000	292,000
1934	.....	.....	247,000	316,000
1935	.....	.....	248,000	330,000
1936 ‡	.....	.....	266,500	359,000

* U. S. Census. † Adjusted to include municipal plant wages omitted from census. ‡ Estimated on ten months' operations.

UTILITY SPENDING AIDS NATION

Major Items, Privately Owned Electric Light and Power Companies

	1922 (Census)	1932 (Census)	1935 Electrical World
Salaries and Wages	$194,148,121	$303,058,039	$307,500,000
Fuel	146,323,332	102,560,395	141,000,000
Other Operating and Maintenance	158,259,407	331,074,301	365,000,000
Taxes	73,128,440	203,858,468	251,000,000
Interest and Amortization	125,595,990	354,165,157	293,000,000
Dividends	129,244,861	493,723,949	305,000,000

Since 1902 the taxes paid per dollar of gross revenue have quadrupled. Taxes now are double the war-time percentage

In 1922 the dollars of capital per dollar of gross revenue were $4.50, in 1936 the dollars of capital per dollar of gross revenue were $6.03

Customers Now Exceed 26,000,000

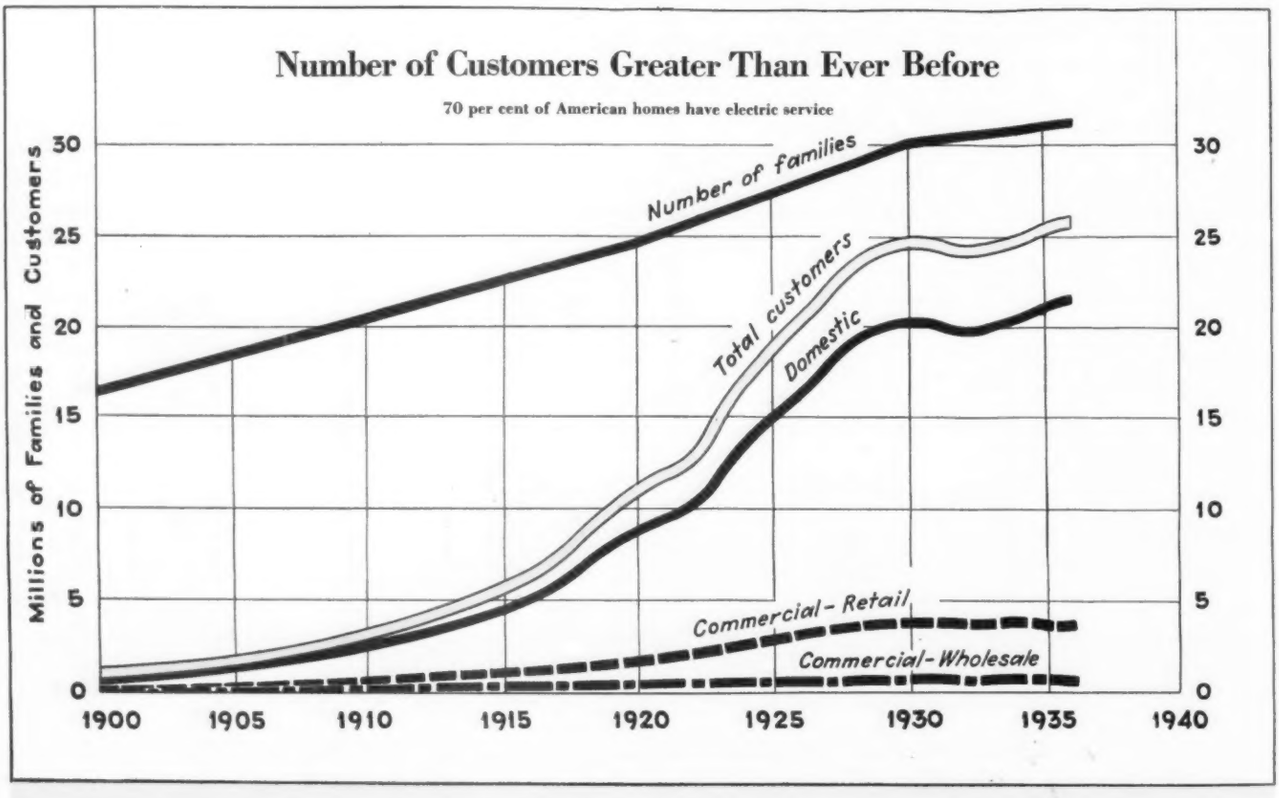
Domestic Customers Increased More Than Half Million — Net Gain of Farm Services Close to 80,000

CONTINUATION of the renewed growth in the number of customers, after the stalemate from 1930 to 1933, has brought the total to the highest point ever recorded. The present estimated 26,028,050 indicates a net gain during the year 1936 of 715,250 in all customer groups.

Most of this was, naturally, in the predominant group—domestic—where the accompanying table by states shows an apparent increase of 543,465. To get the real increase, another 30,300 must be added, making it 573,765. This 30,300 is the number transferred from "domestic" to "farm" to adjust for differences between the 1935 census of farms and company records, as has been announced by the Edison Electric Institute in its statistics on farm electrification. The same adjustment reduces the apparent gain of 109,078 farm customers to a real gain of 78,778.

If farm customers, except in the irrigation areas, are included in "domestic," the total for 1936 becomes 21,648,299, against 21,019,012 in 1935. These are the comparable figures corresponding to "domestic" in the tables for revenue and energy consumption where no separate values are available for farm service.

Of the various elements of growth that characterize the electric light and power industry, some are susceptible of indefinite growth, so far as can now be foreseen. The number of customers is not one of these. For the predominant group, those (including farm homes) receiving domestic service, the limit is set by the number of families, which is now around 31,000,000 and is increasing at the rate of perhaps 200,000 a year. The attainable maximum must fall short of this total; economic reasons, remoteness from service lines, will bar several millions, and with 70 per cent of our people already receiving service the task of serving the remaining 30 per cent becomes increasingly difficult and costly.



AN ELECTRIFIED NATION

	Industrial and Miscellaneous Customers	Commercial Customers	Domestic Customers
1917	243,203	1,125,200	5,810,300
1922	468,312	2,030,324	10,211,232
1927	477,138	3,358,140	17,950,934
1929	581,914	3,598,115	19,967,154
1931	614,510	3,724,013	20,151,247
1933	594,093	3,697,324	20,004,098
1936	579,549	3,800,202	21,648,299

Since 1917 the number of homes served with electricity has increased 3.73 times
Since 1917 the number of commercial, small light and power customers such as stores, offices and the like has increased 3.38 times
Since 1917 the number of industrial and other power customers increased 2.38 times

Central-Station Customers at End of Year

Region or State	Total Number			Farms Served			Domestic			Commercial Lighting and Small Power			Wholesale Power		Municipal and Miscellaneous	
	1935	1936	Change in 1936	1935	1936*	Change in 1936*	1935	1936	Change in 1936	1935	1936	Change in 1936	1935	1936	1935	1936
UNITED STATES	**25,312,802**	**26,028,050**	**+715,248**	**788,795**	**897,873**	**+109,078**	**20,446,436**	**20,989,901**	**+543,465**	**3,710,771**	**3,800,202**	**+89,431**	**304,592**	**276,428**	**62,208**	**63,646**
NEW ENGLAND	**2,331,697**	**2,376,067**	**+44,370**	**59,804**	**77,038**	**+17,234**	**1,923,039**	**1,946,888**	**+23,849**	**304,969**	**307,582**	**+2,613**	**39,960**	**40,152**	**2,925**	**4,407**
Maine	195,626	204,469	+8,843	14,349	14,852	+503	145,212	152,372	+7,160	32,192	33,101	+909	2,614	2,739	1,259	1,405
New Hampshire	130,235	137,365	+7,130	10,186	11,875	+1,689	98,168	102,337	+4,169	17,303	18,193	+890	3,675	3,768	903	1,192
Vermont	84,075	85,913	+1,838	8,116	8,191	+75	61,086	62,668	+1,582	12,355	12,489	+134	2,258	2,300	260	265
Massachusetts	1,242,057	1,254,347	+12,290	14,690	21,000	+6,310	1,042,357	1,048,535	+6,178	164,397	164,314	—83	19,310	19,139	1,303	1,359
Rhode Island	190,090	196,672	+6,582	1,975	2,779	+804	161,928	167,364	+5,436	22,882	23,159	+277	3,265	3,330	40	40
Connecticut	489,614	497,301	+7,687	10,488	18,341	+7,853	414,288	413,612	—676	55,840	56,326	+486	8,838	8,876	160	146
MIDDLE ATLANTIC	**6,999,236**	**7,204,284**	**+205,048**	**124,446**	**141,508**	**+17,062**	**5,737,423**	**5,906,784**	**+169,361**	**1,070,653**	**1,088,939**	**+18,286**	**55,376**	**56,831**	**11,338**	**10,222**
New York	3,681,548	3,773,160	+91,612	61,506	69,182	+7,676	3,001,345	3,074,514	+73,169	581,042	592,935	+11,893	33,193	33,356	4,462	3,173
New Jersey	1,142,242	1,198,219	+55,977	15,356	15,466	+110	929,622	983,027	+53,405	193,175	195,503	+2,328	2,603	2,682	1,486	1,541
Pennsylvania	2,175,446	2,232,905	+57,459	47,584	56,860	+9,276	1,806,456	1,849,243	+42,787	296,436	300,501	+4,065	19,580	20,793	5,390	5,508
EAST NORTH CENTRAL	**5,992,730**	**6,166,620**	**+173,890**	**199,077**	**231,219**	**+32,142**	**4,914,573**	**5,042,025**	**+127,452**	**812,382**	**827,369**	**+14,987**	**49,461**	**48,353**	**17,237**	**17,654**
Ohio	1,636,652	1,690,015	+53,363	52,913	59,976	+7,063	1,356,722	1,398,505	+41,783	209,892	214,341	+4,449	13,536	13,639	3,589	3,554
Indiana	701,740	728,118	+26,378	25,390	31,794	+6,404	566,366	584,882	+18,516	96,760	98,335	+1,575	8,997	8,744	4,227	4,363
Illinois	1,872,021	1,906,945	+34,924	29,485	34,313	+4,828	1,567,918	1,595,525	+27,607	252,354	255,457	+3,103	16,222	15,369	6,042	6,281
Michigan	1,111,038	1,155,852	+44,814	50,876	62,378	+11,502	902,918	931,190	+28,272	152,620	157,697	+5,077	3,454	3,482	1,170	1,105
Wisconsin	671,279	685,690	+14,411	40,413	42,758	+2,345	520,649	531,923	+11,274	100,756	101,539	+783	7,252	7,119	2,209	2,351
WEST NORTH CENTRAL	**2,441,932**	**2,470,615**	**+28,683**	**94,608**	**98,477**	**+3,869**	**1,922,073**	**1,943,002**	**+20,929**	**400,205**	**403,022**	**+2,817**	**18,746**	**20,205**	**6,300**	**5,909**
Minnesota	507,398	515,083	+7,685	14,190	14,275	+85	405,795	411,769	+5,974	84,229	85,803	+1,574	2,187	2,226	997	1,010
Iowa	477,353	482,059	+4,706	32,916	33,819	+903	371,768	374,775	+3,007	69,334	70,107	+773	2,351	2,362	984	996
Missouri	698,343	705,465	+7,122	18,643	19,752	+1,109	564,979	570,270	+5,291	109,496	110,248	+752	4,019	3,974	1,206	1,221
North Dakota	75,904	76,675	+771	1,988	2,051	+63	53,410	54,084	+674	18,754	18,785	+31	1,417	1,419	335	336
South Dakota	89,894	91,727	+1,833	2,928	2,957	+29	64,623	66,079	+1,456	19,498	19,854	+356	2,564	2,538	281	299
Nebraska	244,132	247,322	+3,190	9,946	10,830	+884	191,392	193,529	+2,137	39,525	39,673	+148	2,562	2,564	707	726
Kansas	348,908	352,284	+3,376	13,997	14,793	+796	270,106	272,496	+2,390	59,369	58,552	—817	3,646	5,122	1,790	1,321
SOUTH ATLANTIC	**1,994,527**	**2,065,830**	**+71,303**	**60,096**	**70,040**	**+9,944**	**1,627,769**	**1,689,519**	**+61,750**	**286,451**	**285,534**	**—917**	**15,078**	**14,997**	**5,133**	**5,740**
Delaware	50,738	52,464	+1,726	1,865	1,876	+11	40,007	41,454	+1,447	8,523	8,583	+60	278	290	65	261
Maryl'd, Dist. of Col'mbia	506,630	524,403	+17,773	8,003	8,560	+557	437,084	453,594	+16,510	59,521	59,886	+365	1,794	1,832	228	531
Virginia	289,817	298,420	+8,603	16,088	17,496	+1,408	224,205	232,181	+7,976	44,497	43,994	—503	4,259	3,892	768	857
West Virginia	209,996	218,041	+8,045	5,005	7,972	+2,967	169,495	175,183	+5,688	33,582	32,970	—612	1,649	1,642	265	274
North Carolina	296,201	304,054	+7,853	11,558	13,301	+1,743	248,822	253,441	+4,619	31,011	32,367	+13,56	3,648	3,794	1,162	1,151
South Carolina	120,440	125,976	+5,536	4,763	5,623	+860	97,116	100,771	+3,655	17,005	17,971	+966	1,057	1,108	499	503
Georgia	249,678	251,994	+2,316	7,128	7,437	+309	192,222	197,202	+4,980	48,679	45,861	—2,818	1,053	1,084	596	410
Florida	271,027	290,478	+19,451	5,686	7,775	+2,089	218,818	235,693	+16,875	43,633	43,902	+269	1,340	1,355	1,550	1,753
EAST SOUTH CENTRAL	**847,191**	**883,679**	**+36,488**	**34,485**	**40,116**	**+5,631**	**655,426**	**684,787**	**+29,361**	**142,833**	**143,936**	**+1,103**	**10,844**	**11,159**	**3,603**	**3,681**
Kentucky	288,790	297,179	+8,389	8,991	9,298	+307	230,565	238,187	+7,622	40,115	40,539	+424	7,358	7,294	1,761	1,861
Tennessee	261,956	276,511	+14,555	10,922	13,020	+2,098	205,526	216,557	+11,031	43,122	44,476	+1,354	1,664	1,678	722	780
Alabama	197,870	204,821	+6,951	11,442	14,176	+2,734	148,023	154,150	+6,127	37,345	35,430	—1,915	900	903	160	162
Mississippi	98,575	105,168	+6,593	3,130	3,622	+492	71,312	75,893	+4,581	22,251	23,491	+1,240	922	1,284	960	878
WEST SOUTH CENTRAL	**1,361,722**	**1,432,533**	**+70,811**	**25,036**	**30,898**	**+5,862**	**1,053,889**	**1,108,558**	**+54,669**	**246,701**	**255,487**	**+8,786**	**28,212**	**29,146**	**7,884**	**8,444**
Arkansas	122,303	127,249	+4,946	3,847	4,269	+422	89,571	92,712	+3,141	25,501	26,772	+1,271	1,956	1,914	1,428	1,582
Louisiana	214,617	228,860	+14,243	3,296	3,990	+694	172,110	183,947	+11,837	35,656	37,199	+1,543	2,308	2,465	1,247	1,259
Oklahoma	287,085	297,197	+10,112	5,854	6,418	+564	216,784	224,812	+8,028	49,884	51,022	+1,138	12,928	13,167	1,635	1,778
Texas	737,717	779,227	+41,510	12,039	16,221	+4,182	575,424	607,087	+31,663	135,660	140,494	+4,834	11,020	11,600	3,574	3,825
MOUNTAIN	**669,430**	**689,338**	**+19,908**	**50,405**	**54,922**	**+4,517**	**506,676**	**519,362**	**+12,686**	**96,890**	**98,947**	**+2,057**	**14,439**	**14,838**	**1,020**	**1,269**
Montana	95,891	98,529	+2,638	2,899	3,262	+363	75,919	77,863	+1,944	16,339	16,644	+305	576	595	158	165
Idaho	89,758	94,052	+4,294	14,872	16,362	+1,490	60,945	63,330	+2,385	12,936	13,344	+408	878	888	127	128
Wyoming	35,558	36,481	+923	547	572	+25	28,757	29,483	+726	5,190	5,339	+149	1,015	1,038	49	49
Colorado	206,685	211,504	+4,819	7,236	7,687	+451	162,135	165,756	+3,621	28,952	29,359	+407	8,172	8,511	190	191
New Mexico	34,644	36,004	+1,360	1,400	1,900	+500	24,593	25,068	+475	8,071	8,451	+380	517	517	63	68
Arizona	69,992	71,229	+1,237	5,921	5,931	+10	52,763	53,923	+1,160	10,380	10,420	+40	687	698	241	257
Utah	115,045	117,876	+2,831	16,554	18,217	+1,663	84,783	85,722	+939	11,768	11,994	+226	1,802	1,800	138	143
Nevada	21,857	23,663	+1,806	976	991	+15	16,781	18,217	+1,436	3,254	3,396	+142	792	791	54	268
PACIFIC	**2,674,337**	**2,739,084**	**+64,747**	**140,838**	**153,655**	**+12,817**	**2,105,568**	**2,148,976**	**+43,408**	**349,687**	**389,386**	**+39,699**	**72,476**	**40,747**	**5,768**	**6,320**
Washington	442,747	454,936	+12,189	40,454	41,170	+716	341,734	352,691	+10,957	53,658	54,009	+351	5,747	5,807	1,154	1,259
Oregon	249,796	258,463	+8,667	19,284	20,337	+1,053	191,459	198,240	+6,781	35,767	36,429	+662	2,689	2,716	597	741
California	1,981,794	2,025,685	+43,891	81,100	92,148	+11,048	1,572,375	1,598,045	+25,670	260,262	298,948	+38,686	64,040	32,224	4,017	4,320

NOTE — **Domestic**, combined with farms in non-irrigation areas: 1935, **21,019,012**; 1936, **21,648,299**. Wholesale and miscellaneous combined with farms in W. S. C., Mt., Pac., 1935, **583,079**; 1936, **579,549**. These correspond with revenue and energy totals published elsewhere for corresponding groups. **Farms in irrigation areas: 1935, 216,279; 1936, 239,475.** * Includes reclassification of "farm" to adjust for 1935 census of farms and company records: Mass. + 6,000, R. I. + 800, Conn. + 7,000, W. Va. + 2,000, Fla. + 2,000, Ala. + 2,000, Utah + 1,000, Calif. + 9,500. Total U. S. + 30,300.

Number of Farm Service Customers

(As of December 31)

Region	1936	1935	1934	1933	1932	1931	1930
United States	**897,873**	**788,795**	**743,954**	**713,558**	**705,075**	**698,786**	**649,919**
New England	77,038	59,804	58,006	55,725	52,923	52,237	48,996
Middle Atlantic	141,508	124,446	118,169	109,001	106,759	104,911	96,342
East North Central	231,219	199,077	181,261	172,467	170,421	166,893	151,113
West North Central	98,477	94,608	91,398	89,460	89,652	89,717	82,283
South Atlantic	70,040	60,096	53,307	50,558	49,080	47,958	42,539
East South Central	40,116	34,485	32,062	30,311	31,947	31,513	29,949
West South Central	30,898	25,036	22,883	22,371	22,653	22,170	21,438
Mountain	54,922	50,405	47,876	46,516	45,026	44,308	42,536
Pacific	153,655	140,838	138,992	137,149	136,614	139,079	134,723

Includes reclassification of "farm" customers formerly classified as "residential" to adjust for differences in 1935 census of farms and company records: Mass. +6,000, R. I. +800, Conn. +7,000, W. Va. +2,000, Fla. +2,000, Ala. +2,000, Utah +1,000, Calif. +9,500; total U. S. +30,300.

Growth in Farm Electrification

(Figures on Electrified Farms Do Not Include Those with Individual Lighting Plants)

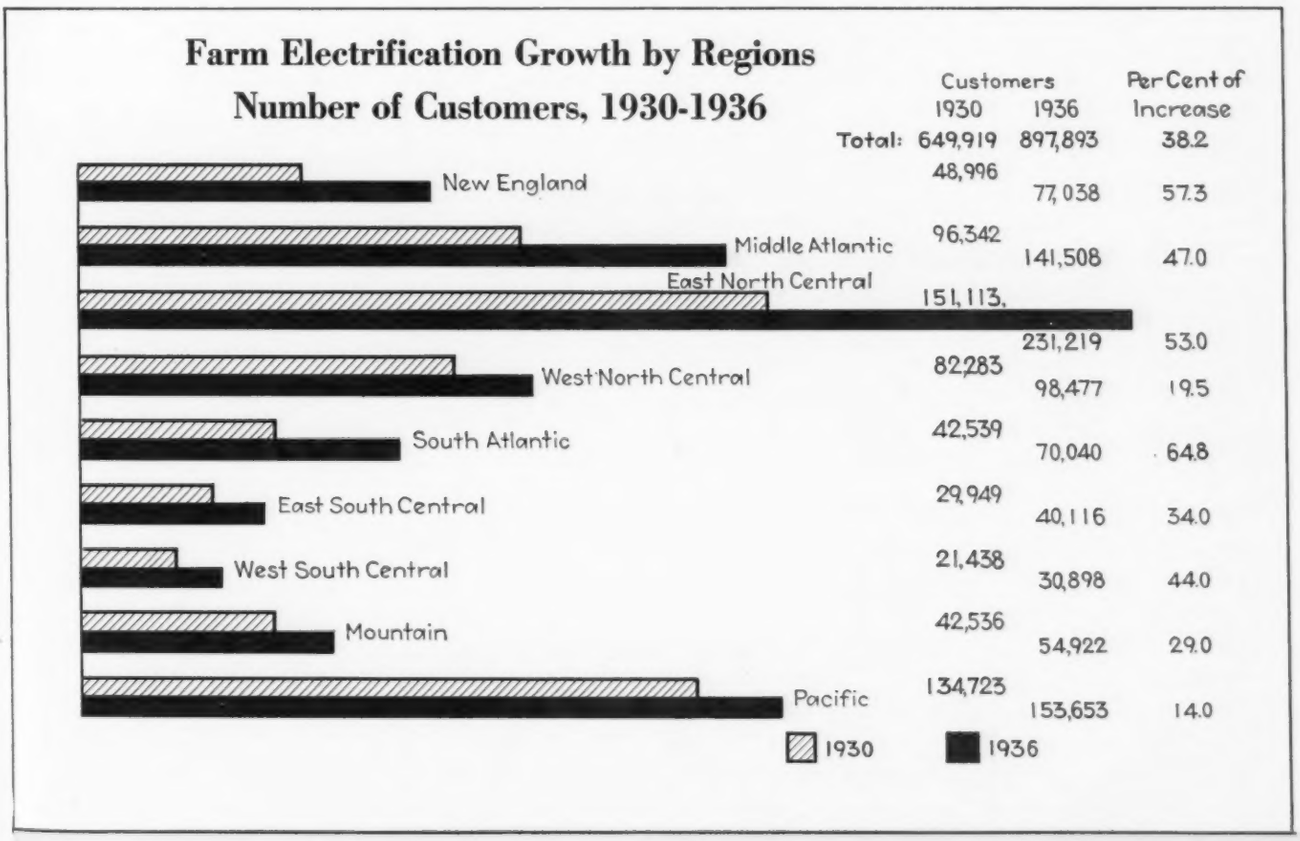
Year	Total Number of Farms	Electrified Farms (Dec. 31)	Per Cent of Total
1925	6,371,640	246,150	3.9
1926	.....	309,125	4.9
1927	.....	393,221	6.2
1928	.....	506,242	8.0
1929	.....	576,168	9.2
1930	6,288,648	649,919	10.4
1931	.....	698,786	11.1
1932	.....	709,449	11.3
1933	.....	713,558	11.4
1934	.....	743,954	11.8
1935	.....	788,795	12.5
1936	.....	897,873	14.3

The most rapid increase came in the middle twenties and the curve of domestic customers was flattening several years before the depression set in. Without that interruption the number might now be around 24,000,000 instead of 21,600,000. The difference of 2,400,000 is a measure of deferred new business.

R.E.A. has allotted loans to projects scheduled to serve 136,659 customers. Plans of private companies call for 75,000 or 80,000, judging from the number of miles to be built.

That makes the total exceed 200,000, even if there is a little duplication in the two figures due to company construction on R.E.A. loans, though the general tendency is for companies to raise their own funds. This is "rural" service, including small communities as well as farms. The figures should not be confused with those for "farm" service exclusively.

Omitting farms having dwellings valued at less than $500, the per cent electrified rises to 20.4 per cent for the whole country, instead of 14.3 per cent. For the New England states the ratio is 53.7 per cent and for the Pacific states it rises to 66.4 per cent.



GENERATOR RATING—Public Utility Power Plants+

Central stations, municipal, railway and other

Preliminary, summarized from records of Federal Power Commission as of November 1, 1936

Division and State	*Companies	Plants	Total Capacity, Kw.	Generator Capacity of Plants Operated By										
				One Type of Prime Mover						Combination of Two or More Types				
				Water Power		Steam Power		Internal Comb. Engines		Total		Water Power	Steam Power	Int. Comb. Engines
				No.	Cap.	No.	Cap.	No.	Cap.	No.	Cap.	Cap.	Cap.	Cap.
United States	**1,616**	**3,803**	**36,597,199**	**1,359**	**10,138,717**	**1,251**	**25,062,608**	**913**	**473,792**	**280**	**922,082**	**266,071**	**544,446**	**111,565**
New England	**137**	**328**	**2,920,532**	**227**	**824,956**	**65**	**1,967,665**	**8**	**6,539**	**28**	**121,372**	**23,811**	**95,090**	**2,471**
Maine	27	80	267,121	66	209,044	7	54,730	3	785	4	2,562	1,196	800	566
New Hampshire	14	56	280,648	44	219,943	4	35,585	1	480	7	24,640	3,850	20,050	740
Vermont	22	72	174,444	62	159,629	3	10,000	.....	.....	7	4,815	1,900	2,710	205
Massachusetts	51	76	1,346,694	31	155,250	35	1,120,990	3	4,049	7	66,405	14,905	50,540	960
Rhode Island	3	7	242,950	3	1,750	4	241,200	.....	.....	.....	.....	.....	.....	.....
Connecticut	20	37	608,675	21	79,340	12	505,160	1	1,225	3	22,950	1,960	20,990	.....
Middle Atlantic	**144**	**396**	**9,310,154**	**202**	**1,420,758**	**149**	**7,700,303**	**18**	**22,292**	**27**	**166,801**	**124,285**	**37,360**	**5,156**
New York	74	238	5,322,636	163	1,137,004	56	4,159,433	4	12,195	15	14,004	5,470	4,435	4,099
New Jersey	13	24	1,070,005	3	950	15	1,059,000	3	2,140	3	7,915	5,100	2,700	115
Pennsylvania	57	134	2,917,513	36	282,804	78	2,481,870	11	7,957	9	144,882	113,715	30,225	942
E. No. Central	**305**	**645**	**7,988,809**	**258**	**626,301**	**295**	**7,112,849**	**48**	**27,164**	**44**	**222,495**	**19,658**	**190,027**	**12,810**
Ohio	66	103	2,164,799	8	10,380	84	2,075,514	7	4,310	4	74,595	3,045	71,350	200
Indiana	55	97	1,041,923	19	29,835	67	999,099	8	5,907	3	7,082	3,380	3,260	442
Illinois	62	99	2,277,727	14	42,315	66	2,144,999	12	3,792	7	86,621	3,910	78,805	3,906
Michigan	59	178	1,584,493	116	310,875	40	1,254,089	13	7,861	9	11,668	2,489	4,114	5,065
Wisconsin	63	168	919,867	101	232,896	38	639,148	8	5,294	21	42,529	6,834	32,498	3,197
W. No. Central	**404**	**782**	**2,724,961**	**112**	**468,565**	**254**	**1,947,766**	**347**	**165,938**	**69**	**142,692**	**14,633**	**94,837**	**33,222**
Minnesota	62	128	596,781	41	151,850	53	428,183	23	9,125	11	7,623	1,858	2,522	3,243
Iowa	80	166	603,060	27	147,400	66	352,411	56	28,030	17	75,219	6,903	60,441	7,875
Missouri	59	103	717,467	7	149,745	38	533,414	51	29,284	7	5,024	.....	1,529	3,495
North Dakota	17	39	69,963	.....	.....	18	64,073	20	5,340	1	550	.....	250	300
South Dakota	27	55	70,819	5	3,970	8	33,547	38	20,394	4	12,908	.....	9,340	3,568
Nebraska	79	159	259,864	24	9,185	40	205,717	74	25,432	21	19,530	3,905	5,113	10,512
Kansas	80	132	407,007	8	6,415	31	330,421	85	48,333	8	21,838	1,967	15,642	4,229
So. Atlantic	**160**	**422**	**4,387,663**	**152**	**1,912,319**	**141**	**2,298,058**	**96**	**45,633**	**33**	**131,653**	**48,417**	**74,609**	**8,627**
Delaware	7	8	30,115	.....	.....	5	28,600	3	1,515	.....	.....	.....	.....	.....
Maryland	12	26	612,786	4	272,045	11	334,460	9	3,391	2	2,890	.....	770	2,120
Dist. of Columbia	2	3	222,400	1	2,400	2	220,000	.....	.....	.....	.....	.....	.....	.....
Virginia	28	73	469,680	35	81,315	17	312,299	14	5,514	7	70,552	15,281	54,900	371
West Virginia	17	38	590,556	9	87,570	19	498,110	7	4,369	3	507	85	147	275
North Carolina	30	83	983,933	49	643,862	22	326,300	6	3,919	6	9,852	6,571	2,180	1,101
South Carolina	14	40	642,510	23	487,140	9	131,690	4	730	4	22,950	16,200	6,600	150
Georgia	19	65	474,517	28	323,807	26	132,700	7	1,758	4	16,252	10,180	5,412	660
Florida	31	86	361,166	3	14,180	30	313,899	46	24,437	7	8,650	100	4,600	3,950
E. So. Central	**84**	**209**	**1,773,859**	**32**	**996,736**	**87**	**709,434**	**78**	**25,386**	**12**	**42,303**	**23,415**	**16,697**	**2,191**
Kentucky	19	41	328,599	3	104,860	24	219,172	9	2,702	5	1,865	315	825	725
Tennessee	27	61	526,001	18	286,386	26	196,752	13	3,781	4	39,082	23,100	15,300	682
Alabama	12	37	855,511	11	605,490	16	246,090	10	3,931	.....	.....	.....	.....	.....
Mississippi	26	70	63,748	.....	.....	21	47,420	46	14,972	3	1,356	.....	572	784
W. So. Central	**160**	**413**	**1,759,713**	**23**	**100,665**	**126**	**1,493,815**	**238**	**117,641**	**26**	**47,592**	**950**	**28,851**	**17,791**
Arkansas	20	60	144,187	5	66,855	30	68,154	20	4,929	5	4,249	.....	1,544	2,705
Louisiana	34	62	313,696	.....	.....	12	290,920	48	21,351	2	1,425	.....	712	713
Oklahoma	49	101	336,784	2	1,500	30	296,236	60	34,088	9	4,960	200	1,747	3,013
Texas	57	190	965,046	16	32,310	54	838,505	110	57,273	10	36,958	750	24,848	11,360
Mountain	**138**	**324**	**1,607,074**	**149**	**1,157,559**	**81**	**382,738**	**65**	**29,195**	**29**	**37,582**	**6,466**	**5,505**	**25,611**
Montana	8	26	309,661	15	299,360	5	7,265	3	1,350	3	1,686	168	643	875
Idaho	17	46	238,477	39	234,465	3	1,100	2	1,372	2	1,540	1,080	.....	460
Wyoming	20	35	43,872	7	15,220	17	23,807	9	3,415	2	1,430	1,000	300	130
Colorado	31	72	242,111	21	53,602	34	180,205	12	6,010	5	2,294	1,344	175	775
New Mexico	16	32	89,160	1	200	11	78,521	16	5,988	4	4,451	808	1,617	2,026
Arizona	19	44	147,488	11	87,050	9	32,090	17	7,474	7	20,874	.....	2,770	18,104
Utah	20	57	154,868	48	89,312	2	59,750	3	1,931	4	3,875	1,670	.....	2,205
Nevada	7	12	381,437	7	378,350	.....	.....	3	1,655	2	1,432	396	.....	1,036
Pacific	**84**	**284**	**4,124,434**	**204**	**2,630,858**	**53**	**1,449,980**	**15**	**34,004**	**12**	**9,592**	**4,436**	**1,470**	**3,686**
Washington	29	69	910,869	45	698,119	14	208,020	3	603	7	4,127	2,206	970	951
Oregon	24	67	338,498	42	175,676	16	156,010	5	1,712	4	5,100	2,030	500	2,570
California	31	148	2,875,067	117	1,757,063	23	1,085,950	7	31,689	1	365	200	.....	165

+ Includes all plants generating energy for public use having a monthly output of 10,000 kilowatt-hours or more.

* Only companies that have generating plants. Excludes those purchasing all their energy.

Utility Plant Capacity Reaches 36,600,000 Kw.

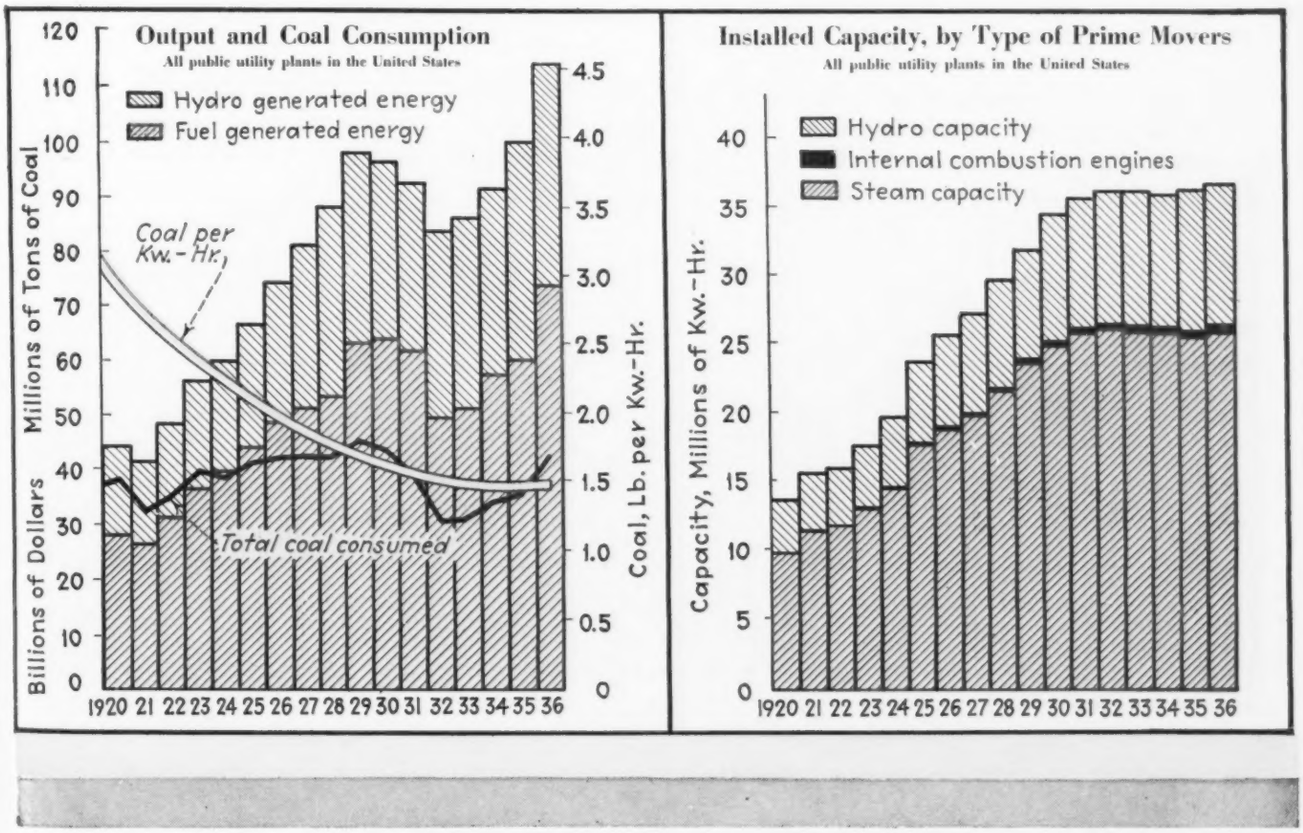
More Than Half Million Kilowatts Added in 1936— Central Station Generating Capacity Now 34,466,000 Kw.

ELECTRIC utilities, by November had added since 1935 more than 440,000 kw. to the generating capacity in their stations and the latest figures (too late to incorporate in the accompanying tables) raise this total to 606,858 kw. for the full year 1936. On the other hand, tentative figures supplied by the Federal Power Commission for the whole electric generating industry (embracing government, municipal, electrified railroad and street railway plants as well as electric service utilities) show an increase of 456,000 kw. over the predecessor Geological figures of 36,133,000 kw. for 1935.

The F.P.C. data presumably include Boulder (165,000 kw.) and Norris (100,000 kw.) dams, in which case there is a crediting of less than 200,000 kw. to the private utility industry for generating capacity increase. However, these discrepancies in current data are to be expected because of the varying criteria adopted in reporting the specific date of adding capacity (it takes 1½ years on the average to design and build a plant and complete the trial operating period).

With reasonable certainty, however, it can be said the electric utilities have added only 2 per cent net to the capacity they had available a year ago to serve the public. Meanwhile the output of the utilities is up 13 per cent. But this does not directly signify that the capacity is short by the full value of the difference between 2 and 13 per cent. The slack that had been accumulating since 1932 must be taken into the reckoning. So it is wiser to assess the present adequacy or inadequacy of capacity on the basis of comparison with, say, 1928. Since that year there has been a net gain of 20.5 per cent in capacity, but during the same interval the output of central stations has grown 28 per cent. In other words, all capacity is, on the average, being worked 6 per cent harder than in the year before the depression crashed into the procession.

Now working equipment more hours and getting a better load factor are meritorious achievements, provided there is no hazardous encroachment on the reserves that are necessary to insure continuous and eco-



nomical generation. That the industry has gone about as far as is safe in this direction is indicated by the fact that the new station capacity announced for 1937 (see page 87) is more than twice as much as was added in 1936. That new increment of capacity will prove pretty handy if the trend of output holds to its present startling movement upward—and there is nothing in sight to suggest even a flattening.

Of the 113,373,000,000 kw.-hr. put out by the whole generating industry, 40,457,000,000 came from hydro sources and 72,916,000,000 came from fuel-burning plants. The relative proportions are 0.365 to 0.635 for hydro and steam respectively. In 1935 the same ratio was 0.403 to 0.597, showing that hydro was used to increased advantage during the year just completed. The drought and the floods did not interfere in the end with getting an increased national annual output, even though the floods did cause expensive damage to hydro plants, interrupted operations and caused much repair outlay.

For the fuel-burning generation total of 73,000,000,000 kw.-hr. there was consumed 42,420,000 tons of coal and enough more oil and gas to represent an equivalent of 52,910,000 tons of coal altogether. On this basis of estimating there was no change from the 1935 figure of 1.46 lb. of coal burned per kilowatt-hour produced.

The combined generating capacity thus used 8,000,000 more tons of coal than in 1935 and 2,600,000 more barrels of oil and 33,000,000,000 more cubic feet of gas. The percentage increases for coal (21.2) and gas (26.7) were of the same order of magnitude as the percentage for oil (22.2).

Considering all plants (as embraced in the Federal Power Commission's table) it appears that there was approximately a gain of 550,000 kw. in hydro capacity and a net loss of 100,000 kw. of steam-generated power. Internal combustion engines rose from 571,095 to 585,357 kw. in capacity; the gains were considerably greater in each of the last fifteen years than in 1936.

Altogether the national generating capacity was applied to an output that for the year represents 3,120 hours of capacity operation. This is nearly equal to the 3,160 hours of 1929.

Capacity (Kw.) of Generators*

In plants generating electricity for public use* in the United States, by type of prime mover (United States Geological Survey)

Year Dec. 31	Water Power	Steam	Internal-Combus. Engines	Total
1920	3,674,541	9,823,622	87,759	13,585,922
1924	5,176,565	14,213,847	126,788	19,517,200
1925	5,976,786	17,485,855	185,859	23,648,500
1926	6,609,484	18,597,984	190,917	25,398,385
1927	7,201,425	19,646,909	203,863	27,052,197
1928	8,116,627	21,214,580	298,495	29,629,702
1929	8,316,591	23,255,692	380,113	31,952,396
1930	9,075,878	24,768,358	419,708	34,263,944
1931	9,670,922	25,467,597	451,553	35,590,072
1932	9,725,096	25,847,184	488,313	36,060,593
1933	9,773,302	25,765,739	499,224	36,038,265
1934	9,788,664	25,560,171	524,990	35,873,825
1935	9,853,808	25,708,209	571,095	36,133,112
1936†	10,404,788	25,607,054	585,357	36,597,199

* Central stations, municipal, electric railway, electrified railroad, Bureau of Reclamation and other. † November 1, preliminary, Federal Power Commission.

Central Station Capacity, Output

Year	Capacity (Kw.)	Output (Mill. Kw.-Hr.)		Fuel Consumption		
		Total	Fuel	Coal [1]	Oil [2]	Gas [3]
1927	25,811,305	74,686	45,968	37,501	7,146	66
1928	28,698,305	82,927	49,419	37,593	6,852	77
1929	29,558,637	91,421	59,031	41,406	9,740	112
1930	31,976,138	89,952	59,388	39,702	8,950	119
1931	33,483,821	86,312	57,742	35,690	7,899	138
1932	34,010,137	77,868	45,991	27,589	7,269	107
1933	33,970,302	79,983	47,533	28,039	9,446	101
1934	33,932,639	85,970	53,808	30,942	10,076	125
1935	34,016,179	93,656	56,067	32,243	11,112	121
1936*	34,466,000	105,828	68,737	38,357	13,565	152

* Estimated on 10 months' operations. [1] Thousands of tons. [2] Thousands of barrels. [3] Billions of cubic feet.

Output, Capacity and Fuel Consumption—All Public Utility Plants

Central stations, electric railway, electrified railroad, public works and other plants generating energy for public use

These statistics relate to *all* plants (not exclusively to central stations) having an output of 10,000 kw.-hr. per month, comprised in the totals reported each month, formerly by the U. S. Geological Survey, since July, 1936, by the Federal Power Commission

Year	Energy Generated (Millions of Kw.-Hr.)			Capacity End of Year (Kw.)	Hours Use of Average Capacity	Fuel Consumed			Coal Plus Coal Equivalent of Oil and Gas‡ (Millions of Tons)	Pounds of Coal per Kw.-Hr.‡
	Total	From Fuel†	From Water Power			Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)		
1919	38,921	24,315	14,606	13,093,972	2,970	35.10	11.05	21.41	38.88	3.2
1920	43,555	27,405	16,150	13,585,922	3,265	37.12	13.12	24.70	41.42	3.0
1921	40,975	26,005	14,970	15,448,126	2,820	31.59	12.05	23.72	35.24	2.7
1922	47,654	30,447	17,207	15,975,287	3,030	34.18	13.20	27.17	38.00	2.5
1923	55,665	36,322	19,343	17,458,367	3,340	38.97	14.68	31.43	43.52	2.4
1924	59,014	39,044	19,969	19,517,200	3,200	37.56	16.63	48.44	43.13	2.2
1925	65,870	43,514	22,356	23,648,500	3,050	40.22	10.25	46.52	44.78	2.1
1926	73,791	47,602	26,189	25,398,385	3,010	41.31	9.40	53.21	45.86	1.95
1927	80,205	50,330	29,875	27,052,197	3,060	41.89	6.78	62.92	45.91	1.84
1928	87,850	53,154	34,696	29,629,702	3,065	41.35	7.16	77.33	46.39	1.76
1929	97,352	62,723	34,629	31,952,396	3,160	44.94	10.12	112.71	52.57	1.69
1930	95,986	62,915	33,021	34,263,944	2,900	42.90	9.26	120.29	50.65	1.62
1931	91,729	61,126	30,603	35,590,072	2,625	38.73	8.12	139.33	47.13	1.55
1932	83,153	49,055	34,098	36,060,593	2,320	30.29	7.97	107.88	36.60	1.50
1933	85,402	50,674	34,727	36,038,465	2,365	30.58	9.94	102.60	37.16	1.47
1934	91,150	57,092	34,058	35,873,825	2,530	33.56	10.38	127.90	41.27	1.47
1935	99,398	59,430	39,968	36,133,112	2,760	34.81	11.39	125.24	43.19	1.46
1936*	113,373	72,916	40,457	36,597,199	3,120	42.42	13.96	158.62	52.91	1.46

* Estimated on basis of ten months' operations. † Includes output by use of wood as fuel. ‡ Wood and production from wood not included.

UTILITIES SUPPLY POWER INCREASE

Distribution of Horsepower in Industrial Plants

Each Horse Represents 5,000,000 Horsepower

	Prime Mover Horsepower Portion Electrified in Color	Horsepower of Motors on Purchased Power
1914	18,406,175	3,884,724
1919	20,041,112	9,282,541
1923	19,727,924	13,364,298
1925	19,902,300	15,864,638
1929	20,155,397	22,775,664
1936	21,000,000	25,100,000

In 1936 the total station capacity in utility and industrial plants was 69,255,000 hp., an increase of 21,160,000 hp. since 1914. The 1936 capacity in utility plants was 33,982,000 hp. of fuel-burning and 14,273,000 hp. of water power.

Since 1919 the added power used by industry has come from public utility plants.

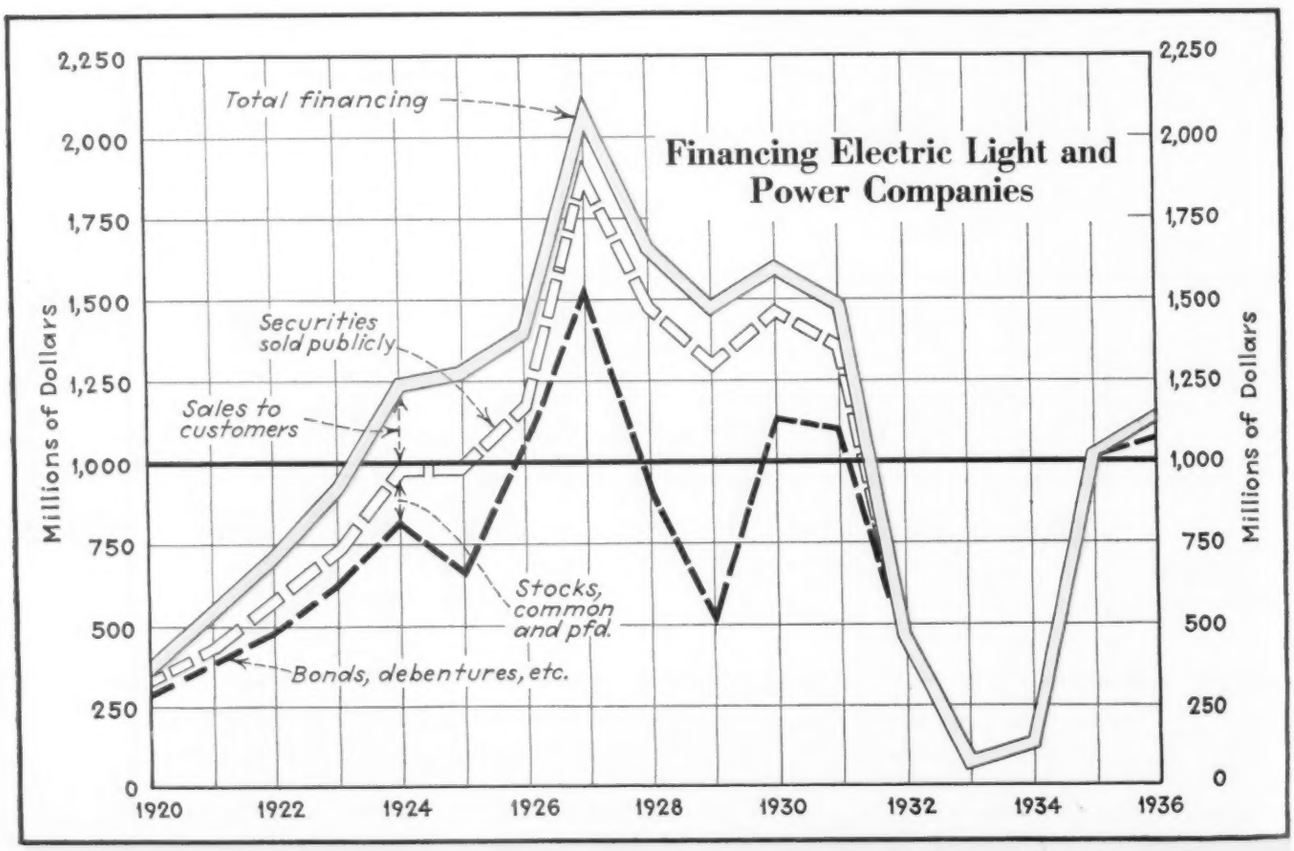
Utility Financing Totals $1,290,106,163

Low Money Rates Enables Industry to Refund Obligations on New All-Time Low Yield Basis — Ten Stock Issues Sold — $44,745,305 New Capital Raised

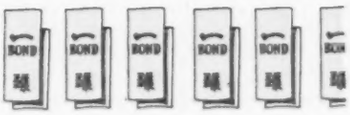
ABNORMALLY low interest rates which prevailed in the capital markets last year brought forth refunding operations by public utilities on an unprecedented scale. The pressure of the Treasury Department, which drove interest rates to such low levels so that the government could finance its tremendous relief and other expenditures, proved highly beneficial in enabling the utilities to refund outstanding obligations into ones bearing a lower coupon rate.

In the past year fifty-eight mortgage bond issues, totaling $1,111,957,200, were sold to yield on the average 3.14 per cent, a new all-time low in utility financing. Ten debenture issues, totaling $103,000,000, were sold to yield on the average 3.30 per cent and five note issues, totaling $22,890,000, were sold to yield on the average 1.79 per cent. The sale of nine preferred stock issues totaling $45,133,963 at an average yield of 3.80 per cent attracted wide attention as a test of the market to such refunding operations. One issue of class A stock, totaling $7,125,000, found its way into the market.

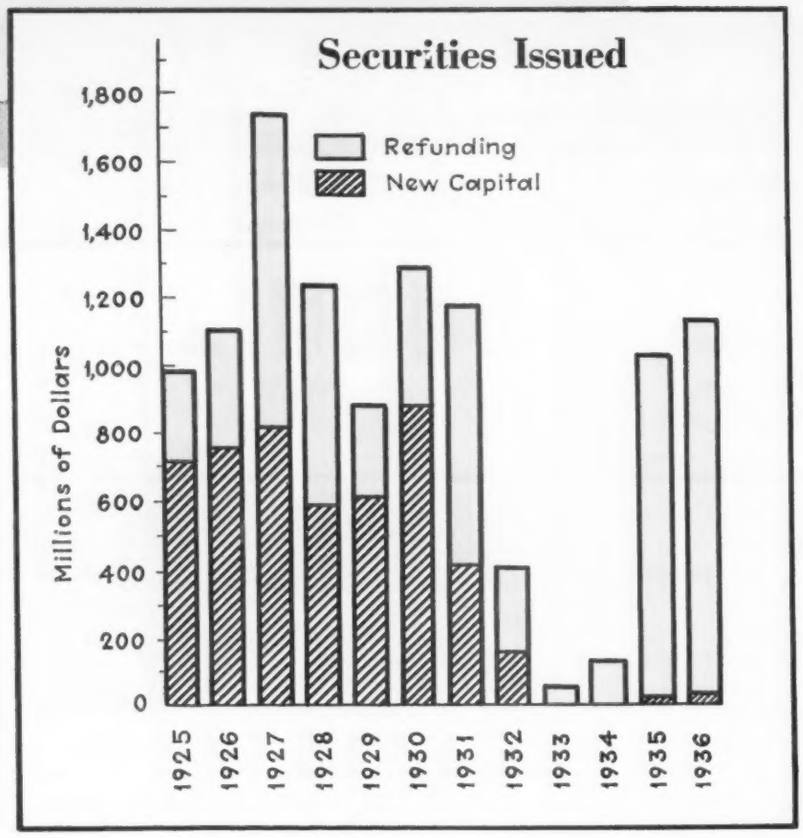
Total utility financing during the past year was $1,290,106,163, of which only $44,745,305 constituted new capital. It is expected that during the new year utilities will continue their refunding programs on a large scale and at the same time raise additional capital, so urgently needed to carry out the construction projects



A REFLECTION OF UTILITY CREDIT

	Preferred Stock Issues	Notes, Bonds and Debentures
1925	$175,582,200 7.01% average yield	$805,338,600 6.05% average yield
1928	$208,802,200 6.16% average yield	$1,528,632,500 5.12% average yield
1930	$179,158,834 5.94% average yield	 $1,114,636,200 5.27% average yield
1932	$92,320,000 5.17% average yield	$1,083,084,000 4.62% average yield
1935	$ No Issues	$1,063,670,700 3.82% average yield
1936	$42,461,463 3.8% average yield	$1,085,904,400 3.13% average yield

Preferred stocks were issued in 1936 to only one-fourth the 1925 amount. Notes, bonds and debentures totaled $1,085,904,400, of which $972,000,000 was in bonds. Of the securities issued, 97.5 per cent was for refunding and average yields were at little more than half the 1925 rate.



New Utility Financing Totals $1,290,106,163

Mortgage Bonds (Av. yield 3.14 %)

No. of Issues	Range of Yield	Amount of Issues
8	3.04–3.17	$196,067,000
15	3.23–3.35	346,401,500
9	3.40–3.57	81,370,000
13	3.60–3.90	293,575,900
9	4.00–4.77	98,542,800
4	Placed privately	96,000,000
58	.....	**$1,111,957,200**

Debentures (Average yield 3.30%)

6	2.75–3.95	92,700,000
3	4.19–5.00	8,800,000
1	.....	1,500,000
10	.....	**$103,000,000**

Notes (Average yield 1.79%)

2	1.87–2.74	2,290,000
2	3.00–3.10	11,600,000
1	Placed privately	9,000,000
5	.....	**$22,890,000**

Preferred Stock (Av. yield 3.80%)

4	4.39–4.90	33,958,828
3	5.14–5.33	2,622,635
2	.....	8,552,500
9	.....	**$45,133,963**

Class A Stock

1	.....	$7,125,000

Total Financing	**$1,290,106,163**
Refunding	**1,245,360,858**
New capital	**44,745,305**

planned, through the issue of new mortgage bonds. Several companies have been giving consideration to preferred stock issues to raise new capital. Many believe that such issues would find ready response from investors seeking a higher yield than that afforded by gilt-edged bonds.

Probably the most difficult obstacles the utilities have to overcome include the uncertainty surrounding the outcome of litigation against the public utility holding company act, the scope or limitations of the T.V.A. activities and the extent to which the government will continue to encourage P.W.A. loans and grants to municipal-

Public Utility Bonds Maturing in 1937

January 1

Amer. Utilities Service, 6% notes	$15,000
Flambeau Power, 1st series 6s, A	12,500
Northern New York Power, 1st 6s	42,000
Snow Mountain Water & Power, 1st 5s	836,000
	$905,500

February 1

Elko Lamoille Power, 1st series, 7s	$5,000
Public Service, Okla., deb. 4s	200,000
Roland Park Elec. & Water, 1st 5s	105,000
	$310,000

March 1

Dayton Lighting, 1st ref. (now 1st) 5s	$1,029,000

April 1

Central Conn. Pwr. & Lt., 1st 5s	$306,000
Iowa Elec., 4% notes	52,000
Iowa Elec. Lt. & Pwr., 3% notes	125,000
	$483,000

May 1

Canton Electric, 1st ref. 5s	$847,000
Great Lakes Power, 1st 6s	160,000
	$1,007,000

June 1

Kansas Electric Power, 1st 6s, A	$3,000,000
Westerly Light & Power, 1st 5s	242,500
Wisconsin Power & Light, deb. 4s	370,000
	$3,612,500

July 1

City Electric, 1st 5s	$715,000
Columbus, Delaware & Marion Elec., 1st and ref. (now 1st) 5s & 6s	3,363,000
Mobile Light & R.R., 1st 5s	224,000
Rochester Central Power, 6% scrip ctfs	22,174
Scranton Electric, 1st ref. 5s	5,756,000
	$10,080,174

August 1

Consolidated Elec. & Gas, 6% sec. notes	$9,122,000

August 15

General Gas & Electric, 5% notes	$92,750

September 1

Redlands Water & Power, 1st closed 5½s	$6,000
Southern Calif. Edison, deb. 2½s	2,000,000
	$2,006,000

October 1

Chicago Dist. Elec. Generating, deb.	$900,000
Iowa Electric, 4% notes	52,000
Iowa Electric Light & Power, 3% notes	125,000
Kings County Elec. Lt. & Pwr., 1st 5s	2,434,000
Richland Public Service, 1st and ref. 5s	686,000
Rochester Central Power, 6% scrip ctfs	21,986
	$4,219,486

November 1

Calif. Gas & Elec., unifying and ref. 5s	$6,741,000
Southwestern Gas & Elec., deb. 4s A	450,000
United Gas & Elec., 1st and ref. 5s	43,000
	$7,234,000

November 15

Arkansas-Pass Rockport Lt., Ice & Pwr., 1st 6s	$19,000

December 1

Clinton Gas & Electric, 1st 6s	$112,000
Total for the year	**$36,434,410**

ities to construct power projects in competition with existing utilities.

The most important factor to govern interest rates during the new year will be the attitude of the Treasury and the Federal Reserve Board toward reserve requirements of banks. Excess reserves have continued to swell following the increase in requirements made last July 15. Talk is now current that reserve requirements will again be raised in which case it may have a stabilizing effect on interest rates and the money market.

There is little doubt that should the utility act reach the Supreme Court during the year and it be held invalid a tremendous flood of utility holding company refunding would deluge the market.

The bearing which the T.V.A. has on utilities operating in the area is indicated by the fact that Commonwealth & Southern declares that if the T.V.A. was limited in its operations and if there were confidence that such limitations would be strictly adhered to the system's Southern companies could refinance to the extent of effecting a $5,000,000 a year saving in interest charges alone.

The extent to which leading utilities were able to refinance on a low yield basis is indicated by the fact that 3¼ per cent mortgage bonds were publicly offered at a premium to yield slightly over 3 per cent. In December the Connecticut Light & Power issue of $16,000,000 of 3¼ per cent mortgage bonds was publicly offered at 104 and interest. The $23,000,000 issue of 3¼ bonds of Consolidated Gas, Electric Light & Power bonds was offered at the same price. During the year Consolidated Edison system units refunded more than $200,000,000 of obligations on 3¼ and 3½ per cent bonds. Pacific Gas & Electric completed its refunding program during the year with the sale of $155,000,000 of 3¾ and 3½ per cent bonds. Practically all of the utility issues sold netted the companies par or better and were sold to the public at a premium which illustrated the soundness of the financial structure of the industry.

Receiverships of 1936

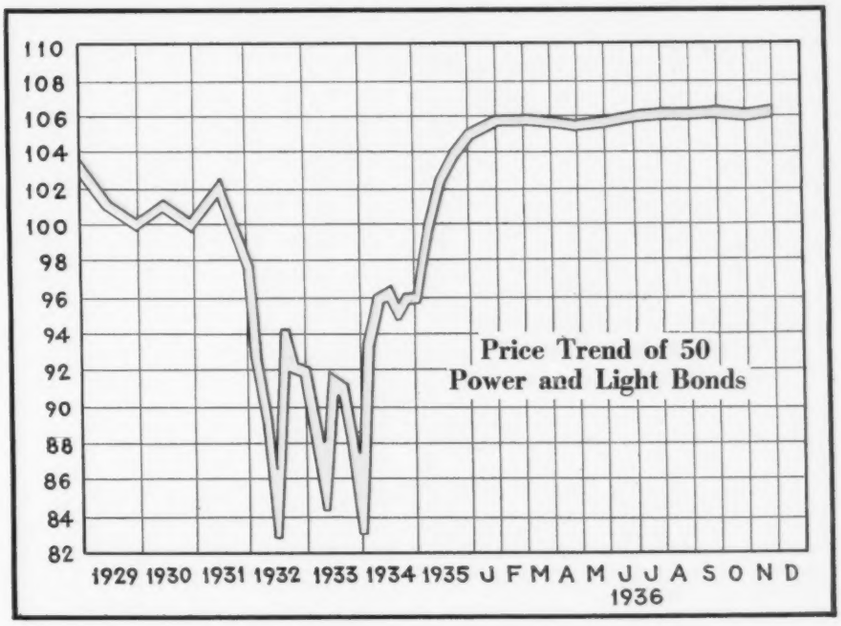
United Telephone & Electric Company
(Trustees appointed)

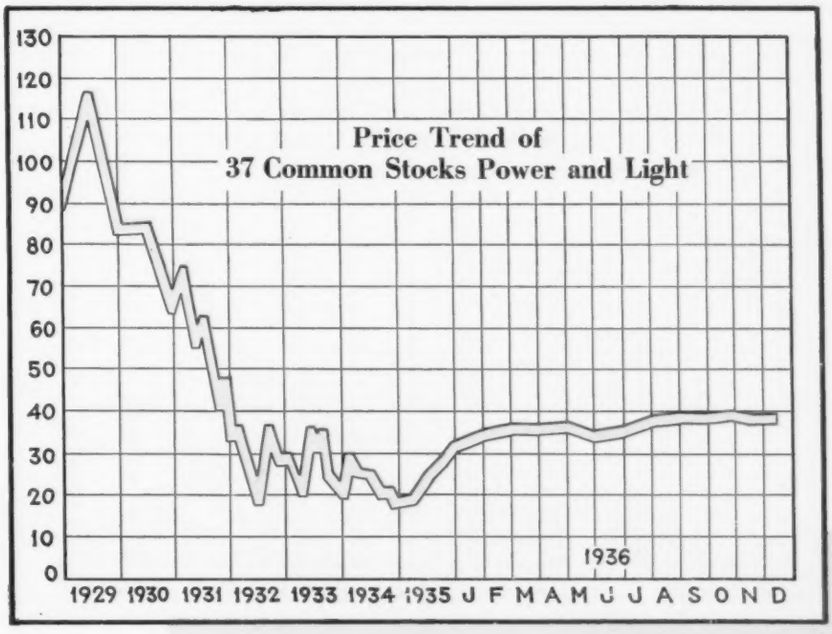
United States Electric Power Corp.
Receivers appointed)

Note—the above list includes companies for which trustees have been appointed under the Corporate Bankruptcy Act and/or for which receivers have been appointed in equity proceedings.

Public Utility Defaults During 1936

Operating Companies		
Alliance Power, 1st 6s, 1952	$571,500	
Arkansas-Missouri Power, 1st 5s, 6s, 7s, '53	3,779,500	
Missouri Gas & Electric Service, 1st ref. 6s A, '44, 1st and ref. 5s B, '57	1,641,000	
Missouri Public Service, 1st 5s A, '47	6,351,000	
Northern Texas Electric coll. tr. 5s, '40, 7% Notes '36	3,551,000	
		$15,894,020
Holding Companies		
North American Gas & Electric, deb. 6s, '44	1,896,000	
Total of all companies defaulted in 1936		$17,790,020





Utility Budget Up to $635,434,000

Capital expenditures up to 60 per cent for 1937 to $531,000,000 —Maintenance approximately same as last year

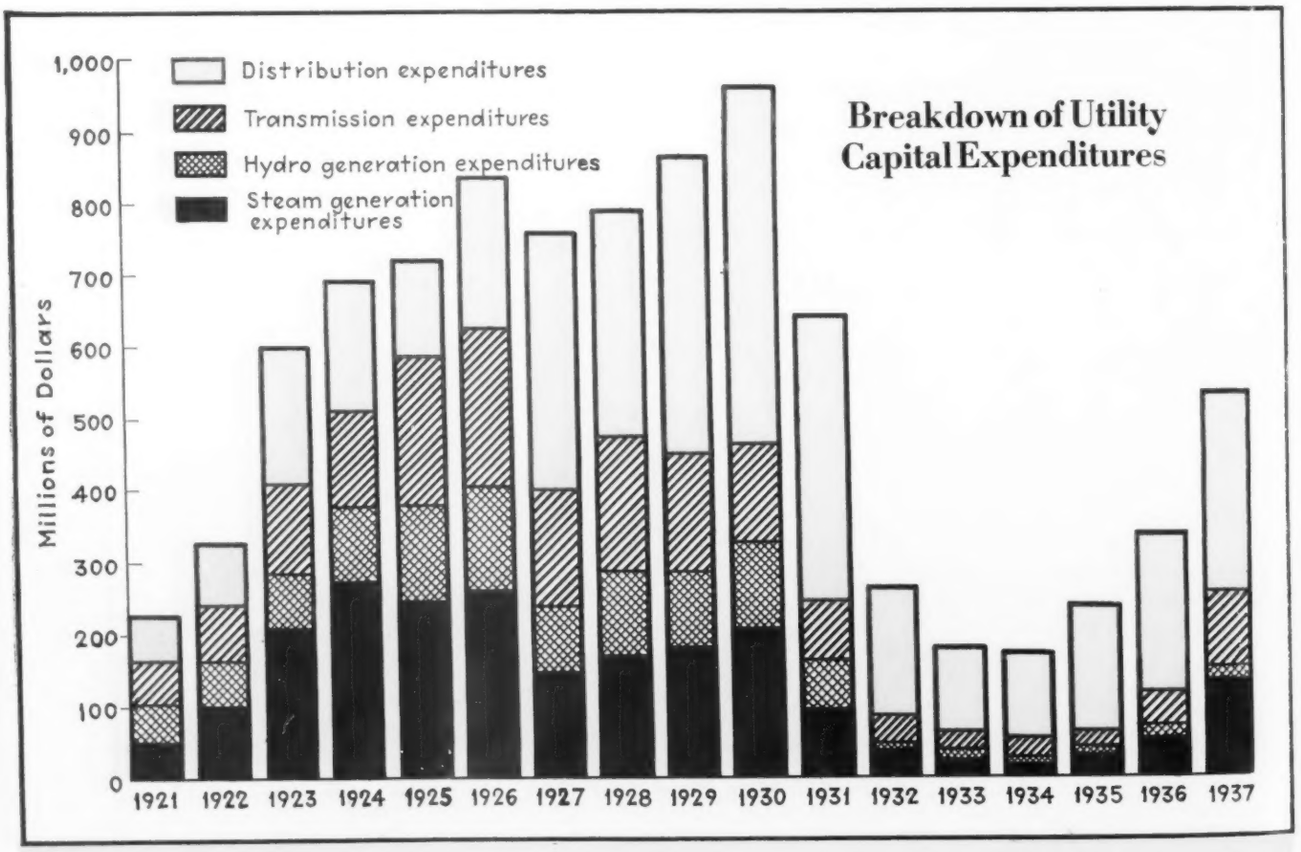
FOR new construction and maintenance the utilities are budgeted to spend in 1937 the sum of $635,434,000, as against $430,822,000 expended last year. While this figure is below the pre-depression levels, it is larger than any year since 1931 and rising very fast.

Of this sum $531,114,000 is set aside for capital expenditures, an increase over 1936 of 60 per cent. It should be much larger, and would were the utilities expanding with respect to load growth on the same long-range basis that they did six to ten years ago. Then there were not the same political and financial problems that there are today. Let these be cleared away so the industry may again have an unclouded long-range view and the budgets can be expected to expand much faster.

At any event, these figures, which are based upon returns from approximately two-thirds of the industry, can reasonably be considered as minimums, with prospects of becoming even larger.

The budget for maintenance is but a few per cent larger than the amount spent in 1936. The maintenance budget has grown approximately 25 per cent in the last four years, but the increase this year is the smallest of all. Offhand, it would appear that utilities have speeded up maintenance and were again back on a standard program. This would seem to indicate that the amount of deferred maintenance was smaller than people generally had been led to expect.

The big increase in 1937 capital expenditures goes to new steam-generating facilities. The jump from $53,235,000 in 1936 to $137,189,000



WHERE CAPITAL EXPENDITURES GO

	Generation	Transmission and Distribution
1921	102,674,000	119,734,000
1925	380,000,000	341,300,000
1929	281,460,000	528,896,000
1930	325,296,000	569,655,000
1932	46,000,000	199,000,000
1933	30,000,000	140,000,000
1935	43,221,000	175,798,000
1936	58,000,000	250,000,000
1937	143,000,000	358,000,000

Capital expenditures for generating equipment increasing rapidly. . . . . Ever since the boom years the capital expenditure for extending service — Transmission and Distribution — has been running about 4 to 1 over Generation expenditures. In 1937 the budget estimates show the ratio to be less than 3 to 1

this year is 158 per cent and is within twenty millions of the entire amount spent for new steam-generating equipment during the previous five years.

Water power, on the other hand, is still quiet so far as expenditures for new equipment by power companies is concerned. Only slightly more than six millions is budgeted for this year, while the average for the past five years has been 7.6 millions. During the 1924–1930 period the average annual expenditure for new hydro equipment by the utilities was 116 millions.

During the past five or six years the budget showed no effort to maintain the ratio balance between the different classes for which capital expenditures are made. Whether by design or otherwise, there has been a restoration of that balance this year, at least so far as steam generation and transmission are concerned. This can best be seen by a comparison with the ratios for the ten-year period 1921–1930:

	1921-1930 Per Cent	1937 Per Cent
Steam	27	25.8
Hydro	14.8	1.1
Transmission	21.9	24.6
Distribution	33.7	46.8
Miscellaneous	2.6	5.5

New transmission line expenditures this year, almost doubling the 1936 allotment, will be but 26 per cent below the 1921–1930 average. Distribution, on the other hand, is 29 per cent greater than it was in 1936 and 9 per cent larger than the 1921–1930 average.

With new customers exceeding 700,000 and with thousands of miles of rural line construction, it is obvious why distribution expenditures have been disproportionately larger than the other items. This matter of unbalance will gradually disappear as plant construction is increased, although the expenditures for distribution will most likely continue to increase.

The expenditures by regions show the South to be expanding in spite of T.V.A. Three times as much generating capacity, for instance, is budgeted by the South for this year as last and more than four times as much for transmission. Distribution in the South, on the other hand, shows but a 32 per cent increase over 1936.

In arriving at the allocations geographically, considerable estimating was involved, since some returns were not broken down, and for that reason the regional figures are necessarily approximations. Nevertheless, the figures may be accepted as typical of what is going on.

Short-range programs

While capital expenditures are showing a very encouraging trend, they are indicative only of a short-range construction program. There was a time when utilities built years ahead in accordance with the projected output curve. In that way there was always an adequate reserve capacity. Today's expenditures, on the other hand, appear to be dictated by today's and tomorrow's needs—not by requirements five or ten years or more hence.

From 1923 to 1930 there was one dollar or more of capital expenditure for every 100 kw.-hr. of output. Had that figure prevailed in 1936, instead of around 35 cents the capital expenditure would have amounted to more than a billion dollars. Likewise, on the basis of dollar of revenue, the capital expenditure is still to a considerable degree on a hand-to-mouth basis. It used to be between 40 and 50 cents per dollar of revenue instead of around 19 cents as prevailed last year.

It cannot be assumed, however, that the industry has been piling up a large backlog of construction during the years that capital expenditures fell below the indices noted, because the 1930 program found the industry with a very large excess capacity beyond reserve requirements on hand.

When the tide started to turn, in 1932, this excess began to be absorbed, but until the 1929 output which occasioned the 1930 construction had been substantially exceeded, it was obvious that there would be considerable excess capacity. Inasmuch as some plant was added each year thereafter, it is probably true that the industry did not absorb the excess until a year or so ago, and since then has been dipping into the reserve. If that be true, then the industry cannot be much farther behind in its investment expenditures, based upon output and revenue indices, than

Utility Expenditures and Budgets

1936 Capital Expenditures	
Generating capacity	$58,331,000
Transmission	56,334,000
Distribution and substations	193,340,000
Miscellaneous	22,082,000
Total	330,087,000
1936 Maintenance Expenditures	100,735,000
Total Capital and Maintenance	430,822,000
1937 Capital Budget	
Generating capacity	$143,235,000
Transmission	109,281,000
Distribution and substations	249,186,000
Miscellaneous	29,412,000
Total	531,114,000
1937 Maintenance Estimate	104,320,000
Total Capital and Maintenance	635,434,000

Capital Expenditures, 1936, by Regions

(In thousands of dollars)

Region	Steam	Hydro	Transmission	Distribution	Miscel.	Total
East	18,515	2,627	6,604	75,404	7,878	111,028
Central	25,291	913	29,251	56,482	8,911	120,848
South	7,416	234	7,609	38,200	2,583	56,042
West	2,013	1,322	12,870	23,254	2,710	42,169
United States	53,235	5,096	56,334	193,340	22,082	330,087

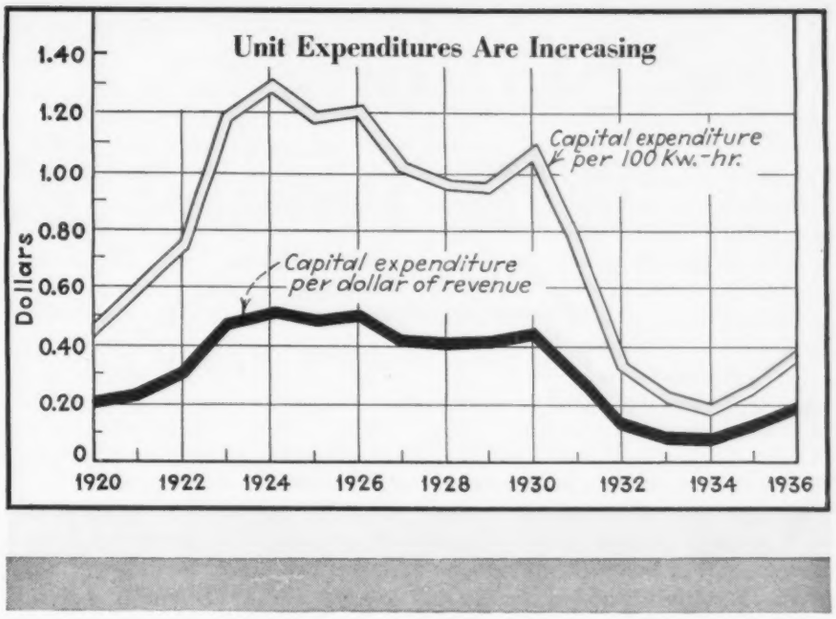
Prospective Capital Expenditures, 1937

East	52,525	726	16,595	98,133	10,864	178,843
Central	57,871	2,176	39,876	67,809	12,183	179,915
South	22,033	241	33,452	50,452	2,619	108,797
West	4,760	2,903	19,358	32,792	3,746	63,559
United States	137,189	6,046	109,281	249,186	29,412	531,114

approximately two-thirds of a billion, with perhaps another half billion for 1937. If the atmosphere clears it may be only a matter of months before hand-to-mouth buying and building gives way to an accelerated rate comparable to the previous boom period.

In this connection it is interesting to note that the output curve in December was rising much faster than the average for the year, establishing new peaks. The margin of reserve safety is, therefore, narrowing, and a continuation of large output increases might easily produce a speeding up of capital appropriation for generation and transmission construction.

The caution that is being exercised by the light and power industry is necessary until such time as it can again enjoy stability of both local regulation and governmental restraints, and also until there is more long-range stability to the financial market, with definite indications of a sufficiency of equity money. The expansion problem facing the power industry in some ways is not unlike that facing industry in general. Is this present upturn to be of long duration, leading to a new permanent level of business, or will it burn itself out in another two or three years? Until industry can see further ahead than two years or so, it is not going to be inclined to make very long-range commitments. The light and power industry will necessarily be greatly influenced by that kind of thinking. In the meantime the increase in demand for energy is sufficient to produce rapidly rising budgets for capital expenditures. Large expenditures of capital for long-range future expansion must wait until the vision is clearer.



To a considerable degree the outcome of pending litigation will affect the budget expansion program. Favorable decisions would do much to boost the public demand for light and power company investments as well as to preserve a channel for equity financing, which is so important to any balanced expansion program. Nothing official has come out of Washington to indicate what plans the Administration is shaping up for the next four years with respect to utility matters. It should be obvious, however, that a full restoration of public confidence in the light and power industry unimpeded by additional federal restraint or interference would go a long way in setting up a situation that would accelerate recovery.

Accurate agreement between expenditures for a given year and the new capacity installed in that year is not to be expected. The fact that a certain 10,000-kw. steam plant happened to go into operation in a given year does not necessarily signify that the entire cost was incurred in the same calendar year. It may have started operations in January, for instance, in which case most of the money was spent in the preceding one or two years. Likewise, some of the money in the 1937 budget will be for construction of facilities that will not go into operation until 1938 or perhaps 1939. It must be remembered that deliveries are longer today.

As the year advances this is expected to become more serious with the result that some commitments might be made for equipment to be placed in operation in 1940.

The main point is that budgets for new construction are definitely increasing and promise to be still greater in the near future.

Add to them the sums set aside for federal expenditures for power development and for the R.E.A. projects and the total begins to take on proportions more in keeping with predepression totals. The prediction, therefore, that the market for electrical products might in 1937 approximate the 1929 peak is to some considerable degree substantiated by these figures.

Central Station Capital Expenditures for New Construction by Classes

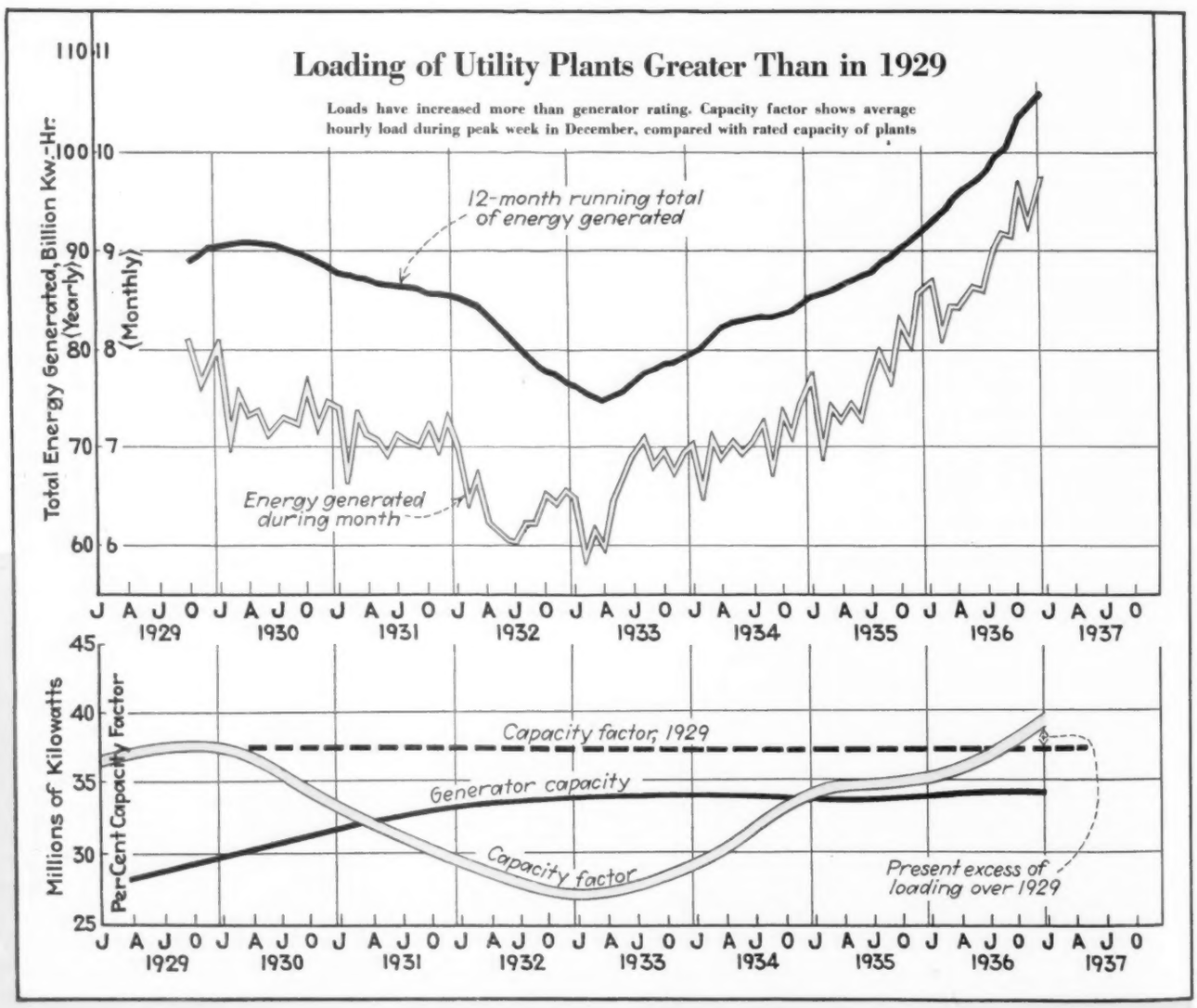
(In Thousands of Dollars)

	Steam	Hydro	Transmission	Distribution	Miscellaneous	Total
1921.....	49,858	52,816	60,657	59,077	.....	222,408
1922.....	100,543	63,790	75,588	84,095	.....	324,016
1923.....	209,417	74,396	125,200	193,130	.....	602,143
1924.....	269,700	109,540	134,190	179,010	.....	692,440
1925.....	240,000	140,000	205,700	135,600	.....	721,300
1926.....	255,107	145,000	231,061	210,176	.....	841,344
1927.....	146,017	88,866	163,153	362,317	.....	760,353
1928.....	171,033	113,841	186,190	267,606	48,308	786,978
1929.....	182,548	98,912	167,565	361,331	55,988	866,344
1930.....	207,901	117,395	137,085	432,570	65,938	960,889
1931.....	96,147	66,695	80,913	347,883	41,775	633,413
1932.....	40,000	6,000	42,000	157,000	15,000	260,000
1933.....	20,000	10,000	25,000	115,000	10,000	180,000
1934.....	13,000	7,000	35,000	105,000	10,000	170,000
1935.....	33,200	10,000	20,800	155,000	18,000	237,000
1936.....	53,235	5,096	56,334	193,340	22,082	380,087
1937 (Est.)	137,189	6,046	109,281	249,186	29,412	531,114

New Stations Will Total 1,270,000 Kw.

Steam Increments Principally in Existing Stations — New Water Power Is Primarily Under Government Auspices — Two Million Kva. in Substations Scheduled

NET increase in the generating capacity of privately and publicly owned power plants was reported at 606,858 for the year 1936. There is scheduled for 1937 slightly more than twice as much, 1,272,930 kw. in fact, and thus the electrical industry has begun in earnest to prepare for loads that keep on rising and brook no shortage in capacity. The 1936 gain is called net because the industry reported retirements during the year of 114,235 kw., of which 10,178 was municipal, otherwise the gain would have been 721,093 kw. Practically all the abandoned capacity is steam, so that clears the way that much for "topping"



Summary of Additions

New Capacity Scheduled for 1937

Kw.	Private	Municipal and Federal	Total
Steam	792,450	170,000	962,450
Hydro	29,550	270,400	299,950
Int. comb'n	4,780	5,750	10,530
Total	826,780	446,150	1,272,930

New Capacity Added in 1936

Steam	177,450	34,450	211,900
Hydro	48,920	440,945	489,865
Int. comb'n	8,750	10,578	19,328
Total	235,120	485,973	721,093
Retirements definitely reported			114,235
Apparent net increase			606,858

units or complete station capacity elsewhere.

During 1937 the private utilities will be adding 4½ times as much new steam-generated capacity as they did during 1936. Meanwhile the governmental hydro activities will put on the line only 270,400 kw., as against 440 000 in 1936, and all municipal and federal activities will result in adding only 446.150 kw. in 1937, as against 485,973. Thus the private utility industry is to be credited not only with all the increase of 550 000 kw. but also with offsetting the decline of 40,000 kw. in governmental additions. The actual addition is within 7 per cent of what was prognosticated a year ago; the rest will mature in 1937. None of these figures include the capacity that is being discussed, no matter how actively, unless actually budgeted. Capacity well upward of 2,000,000 kw. could be listed for 1937 to include the potentially active.

Of the 792,450 kw. scheduled by private utilities, there will be 742,450 kw. installed in existing stations and only 50,000 kw. reported as entailing new stations. This fact constitutes a forceful testimonial to the foresight of the industry in building plants large enough during the last decade to house increments whenever they were justified. Another big factor is, of course, the current popularity of the superposed turbine and a respectable percentage of the added installations are of this type, which takes advantage of the gains from higher temperature and pressure without displacing serviceable equipment of lower levels of temperature and pressure.

Largest among the increment in water power for 1937 is, of course, the availability of two more of the 82,500-kva. generators driven by 115,-000-hp. wheels at Boulder Dam to serve Los Angeles. Private utilities added only a fourth as much hydro as steam in 1936 and in 1937 it will dwindle apparently to 1/27 as much hydro as steam. Meanwhile, for each of the two years, the government and municipalities are putting in about nine times as much hydro as the private utility industry. Incidentally, the internal combustion generation reported scheduled in 1937 is only half as much as it was in 1936.

Among the 1937 scheduled plants the largest increment reported is the 75,000-kw. item from the St. Louis system. Next in order is 60,000 kw. for Detroit Edison and 50,000 kw. each for Consolidated Edison (N.Y.) and West Penn Power. That the increments accruing for 1937 reflect the caution of the period when these commitments were authorized can be seen from the predominance of units ranging from 15,000 to 35,000 kw. Whether this trend away from larger units is merely temporary or rather permanent is a development that will

Capacity Added in 1936

Steam

Private Companies	New Plants, Kw.	Additions, Kw.
United Illuminating	.....	5,000
Rochester Gas & Elec	.....	6,000
Keystone Pub. Service	.....	5,000
Ohio Public Service	.....	5,000
Detroit Edison	.....	60,000
Mt. Carmel (Ill.) P. U. & Service	.....	1,500
Kansas City Pwr. & Lt	.....	25,000
St. Joseph Ry., Lt. H. & Pwr	.....	7,500
LaClede Pwr. & Lt	.....	5,000
Missouri Utilities Co	.....	3,500
Virginia Elec. & Pwr. Co	.....	12,500
Virginia Public Service	.....	5,000
Potomac Edison & Subsid.	.....	7,000
So. Carolina Utilities	.....	1,000
Savannah El. & Pwr	.....	7,500
Utah Power & Light	18,750	.....
Cheyenne Lt. Fuel & Pwr.	.....	1,500
Rawlins Electric	.....	750
	18,750	158,750
Municipal Plants		
Springfield, Ill	10,000	.....
Orrville, Ohio	.....	1,500
Peru, Ill	.....	1,250
Buffton, Ind	400	.....
Van Buren, Mich	.....	2,000
Blissfield, Mich	500	.....
Rockland Center, Wis	.....	1,250
Moorehead, Minn	500	.....
Fairmont, Minn	.....	1,500
Hibbing, Minn	.....	2,500
New Ulm, Minn	.....	1,250
Hannibal, Mo	.....	7,500
Stillwater, Okla	.....	2,500
Pasadena, Calif	.....	1,800
	11,400	23,050

Water Power

Private Companies		
Public Serv. of New Hampshire	18,000	.....
Holyoke Water Power	.....	10,000
Connecticut Lt. & Pwr	.....	8,800
Newport (Vt.) Elec. Corp.	1,875	.....
Central Vermont P. S.	.....	1,300
Litchfield El. Lt. & Pwr.	320	.....
Wisconsin Public Service	3,025	.....
Idaho Power	.....	1,600
Public Service of Colorado	.....	4,000
	23,220	25,700
Municipal Plants		
Norwich, Conn	800	.....
Shawno, Wis	.....	312
Idaho Falls, Idaho	.....	1,500
Seattle, Wash	133,333	.....
Los Angeles, Calif. (Boulder Dam)	165,000	.....
	40,000	
Federal		
T. V. A. Norris Dam	100,000	.....
	439,133	1,812

Internal Combustion

Private Companies		
Cape & Vineyard	.....	500
Oswegatchie Lt. & Pr	.....	600
General Minn. Utilities	.....	190
Iowa-Nebraska Lt. & Pwr	.....	2,500
Iowa Public Service	730	.....
Northwestern P. S. (Huron, S. D.)	.....	1,000
Western Light & Power	.....	560
Eastern Shore Pub. Serv	.....	1,000
Louisiana Pub. Util	.....	600
Arizona Edison	.....	700
Idaho Power	.....	370
	730	8,020
Municipal Plants		
Arcade, N. Y	.....	575
Rochelle, Ill	.....	1,150
Wahoo, Neb	.....	1,000
Sioux Falls, S. Dak	.....	1,000
Madison, S. Dak	.....	690
Grafton, N. Dak	.....	600
Shelburn, Mo	.....	480
Blair, Nebr	.....	430
Jackson, Minn	.....	300
Vero Beach, Fla	.....	753
Easton, Md	.....	700
Lubbock, Tex	.....	1,100
Logan City, Utah	1,800	.....
	1,800	8,778

Capacity Scheduled for Completion in 1937

Steam

Private Utilities	New Plants Kw.	Added to Existing Plants, Kw.
Connecticut L. & P.	.....	25,000
New Hampshire G. & E.	.....	4,000
Consolidated Edison	.....	50,000
N. Y. State Gas & Elec.	.....	20,000
West Penn Power	.....	50,000
Rochester Gas & Elec.	.....	7,500
Metropolitan Edison	.....	15,000
Detroit Edison	.....	60,000
Commonwealth Edison	.....	30,000
Cincinnati Gas & Elec.	.....	35,000
Dayton Power & Light	.....	25,000
Lake Superior Dist. Pwr.	.....	5,000
United Power Mfg.	.....	20,000
Union Elec. Lt. & Pwr. & Subs	.....	75,000
Northern States Power	.....	3,000
Western Light & Power	.....	3,000
Potomac Elec. Power (1938)	.....	35,000
Potomac Edison & Subs.	10,000	.....
Monongahela West Penn P. S.	.....	25,000
Chestertown E. L. & P.	.....	750
Louisville G. & E.	.....	25,000
Kentucky-Tennessee L. & P.	.....	5,000
Southwestern L. & P.	.....	5,000
Arkansas Power & Lt.	20,000	.....
Public Serv. of Colorado	.....	25,000
Tucson Elec. Lt. & Pwr.	.....	6,000
Sheridan County Elec.	.....	3,000
San Diego Consol. G. & E.	.....	35,000
	30,000	592,450
10 companies report prospective construction, net yet announced	20,000	150,000
Total steam	50,000	742,450
Municipal Plants		
Jamestown, N. Y.	.....	15,000
Penn Yan, N. Y.	.....	2,000
Hamilton, Ohio	.....	10,000
Norwalk, Ohio	.....	2,500
Orrville, Ohio	.....	2,500
Anderson, Ind	.....	10,000
Decatur, Ind	.....	2,000
Washington, Ind.	.....	2,500
Springfield, Ill.	.....	20,000
Winnetka, Ill.	.....	3,000
Woodstock, Ill.	.....	5,000
Virginia, Minn.	.....	2,500
Marshall, Mo.	1,500	.....

Municipal	New Plants, Kw.	Added to Existing Plants, Kw.
Omaha, Neb.	.....	10,000
Kansas City	.....	30,000
Brookings, So. Dak.	.....	1,500
Rocky Mount, N. C.	.....	7,500
Owensboro, Ky.	5,000	.....
Canton, Miss.	.....	600
	6,500	126,600
10 cities report prospective construction, not yet announced	700	36,200
Municipal steam	7,200	162,800

Water Power

Private Utilities		
Pub. Serv. of New Hampshire	.....	1,800
Public Elec. Lt. (St. Albans, Vt.)	3,750	.....
Wisconsin Pub. Service	2,500	.....
Arkansas P. & L.	20,000	.....
Virginia Elec. & Pwr.	.....	300
	26,250	2,100
Prospective but not yet scheduled	1,200	.....
	27,450	2,100
Municipal		
Holyoke, Mass.	.....	1,500
Danville, Va.	3,000	.....
Los Angeles, Calif. (Boulder Dam)	165,000	.....
Prospective but not yet scheduled	12,500	2,000
Federal		
Bonneville	86,400	.....
	266,900	3,500

Internal Combustion

Private Utilities		
Central Elec. & Tel.	.....	600
Prospective but not scheduled	1,000	3,180
Total private	1,000	3,780
Municipal		
Goshen, Ind.	.....	1,000
Prospective, not yet scheduled	1,000	3,750
Total municipal	1,000	4,750

be watched closely in the coming months. Two municipal plants adopted smaller units, the largest reported being 30,000 for the Kansas City, Kan., plant. Again, all but two of the municipal items were for increments to existing stations.

Data tabulated for the municipal properties is based on a 50 per cent return from 503 inquiries addressed to all municipal plants serving 2,000 or more population. To the private utilities went 503 queries and the return was of such proportions as to indicate about a 90 per cent coverage of activity. No projection has been made to any of the preceding data to embrace the unreported figures or properties.

Transmission line mileage planned for 1937 amounts to 2½ times as much as in 1936 for the private companies and 1 3/5 times as much for the municipals. For the coming year there is, therefore, scheduled practically 3,500 miles of line which is of higher voltages than used for direct distribution and consequently embraces some rural feed lines. Again these and the tabulated figures cover only reported mileages. Based on number of customers, this data represents a 70 per cent coverage and, therefore, it could be said that there will probably be 5,000 miles of transmission and the higher voltage rural feed lines built in 1937.

The same companies and municipals show a reported doubling of substation capacity construction in 1937 over the 1936 activity. Applying the extension factor, it appears that 1937 will see the construction of practically 2,000,000 kva. in substation capacity.

▼ ▼ ▼

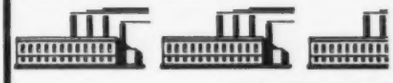
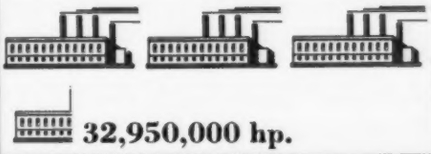
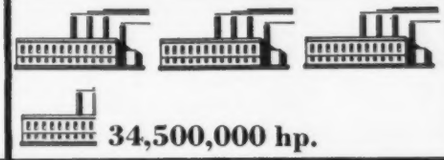
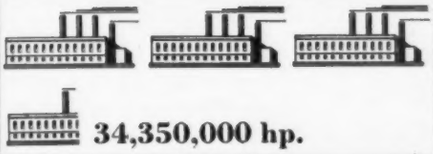
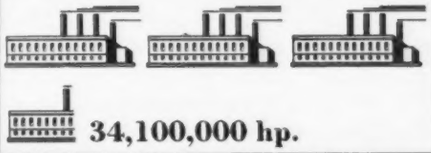
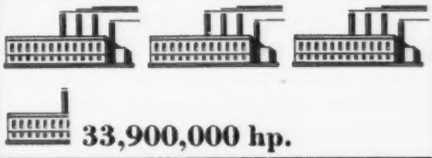
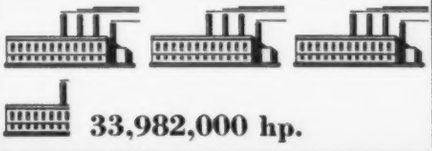
Transmission Miles Reported

		Private Utilities		Municipal		
No.	Region	1936	1937	No.	1936	1937
36	New England	50.72	65	29	14.05	14
43	Mid. Atlantic	84.07	401	22	1.2	2
39	E. No. Central	108.8	344	62	82.5	614
37	W. No. Central	91.25	541	55	115.5	238
17	So. Atlantic	175.20	167	22	159.75	47
11	E. So. Central	50.62	87	10	5	2
24	W. So. Central	95.5	346	6	5	0
31	Mountain	145.15	259	10	20.5	30
13	Pacific	32.45	65	10	286	167
251	United States	833.76	2,275	226	689.5	1,114

Construction of Substations Reported (Kva.)

		Private Utilities		Municipal		
No.	Region	1936	1937	No.	1936	1937
36	New England	86,650	106,083	29	2,300	307
43	Mid. Atlantic	137,591	384,839	22	0	0
39	E. No. Central	173,773	344,705	62	19,650	10,450
37	W. No. Central	98,000	143,825	55	15,505	15,450
17	So. Atlantic	122,025	71,150	22	9,850	2,675
11	E. So. Central	26,690	30,550	10	0	0
24	W. So. Central	22,325	87,650	6	2,000	0
31	Mountain	24,250	67,350	10	25,050	5,000
13	Pacific	14,515	136,600	10	6,750	126,000
251	United States	705,819	1,372,752	226	81,105	159,882

CENTRAL STATION CAPACITY ON UP-GRADE

	Capacity of Fuel-Burning Plants	Capacity of Hydro Plants	Total Horsepower
1922	14,000,000 hp.	5,800,000 hp.	19,800,000
1927	 25,850,000 hp.	9,850,000 hp.	35,710,000
1931	 32,950,000 hp.	14,150,000 hp.	47,100,000
1932	 34,500,000 hp.	13,550,000 hp.	48,050,000
1933	 34,350,000 hp.	13,600,000 hp.	47,950,000
1934	 34,100,000 hp.	13,600,000 hp.	47,700,000
1935	 33,900,000 hp.	13,700,000 hp.	47,600,000
1936	 33,982,000 hp.	14,273,000 hp.	48,255,000

Since 1922 the generator capacity of the electric utilities has increased 2.4 times and is now nearly 50,000,000 horsepower

Ratio of steam to hydro power of privately owned utilities is now 5 to 2, as it was in 1922, and the proportions have varied only slightly from that value

Rural Mileage Expected to Exceed 36,000 in 1937

Expenditures Seen Reaching $48,000,000
Record-Breaking Pace to Continue

THE public utility industry will continue its 1936 record-breaking rural construction program in 1937, and expects in addition to exceed the 1936 totals.

Another 160,000 rural customers will probably be connected to public utility lines. This figure may not increase over the 1936 total, because the 1937 rural construction will tap fewer customers per mile. The significance of 160,000 added rural customers will be better appreciated when it is recalled that only 4,000 farm customers were added in 1933, 30,000 in 1934, 56,000 in 1935—compared to 85,000 in 1936.

The data for 1937 are supplied by companies serving 16,101,483 customers, or 63.5 per cent of the total. The figures shown in the tables should be adjusted, therefore, for 1937. Rural miles reported, on this adjusted basis, amount to 26,110.

Municipal plants report 1,402 miles to be constructed. The Rural Electrification Administration estimates have indicated about 8,000 miles for 1936, and if 9,000 is taken for 1937 the grand total for rural construction in 1937 is 36,512 miles.

R.E.A. had allotted, up to December 5, 1936, $41,959,778 to build about 40,000 miles of line. Actual expenditures and construction, however, for the year 1936 were thought to be $2,725,000 and 8,000 miles respectively.

Reporting utilities advised that they would invest $19,198,989 in rural lines during 1937. Adjusted for all companies, the total becomes $30,234,000. Municipals stated their total would be $1,735,360. If R.E.A. constructs 9,000 miles this year, the expenditure would approximate $3 066,000, with a grand total of $35,035,000 for lines.

The latest available nation-wide data (ELECTRICAL WORLD, October 17, 1936, page 4) show 36.6 cents invested in meters, services and transformers per dollar of line only. Upon this basis, then, $12,823,000 will be expended for this equipment and $48,000,000 will be the total for 1937.

Most companies to continue rural programs

A further study of the reports, confined to those companies which reported completely for both 1936 and 1937, shows, in round numbers, 20 per cent more miles scheduled for New England; 17 per cent more miles for the East North Central group; about the same for the West North Central; a decrease of 18 per cent in the South Atlantic group, due entirely to two companies which, however, report 2,000 miles will be built in 1937; a 28 per cent increase in the West South Central group; 10 per cent increase in the Pacific group and Mountain group; 20 per cent for the East South Central group.

The point here is that the companies as a whole will advance their last year's programs substantially, but the mileage for the industry as a whole does not reflect this due to the great weight exercised by the somewhat reduced programs of a handful of companies engaged in large-scale rural development.

Great social contribution to progress of nation

The public utility industry and the R.E.A. cooperatives will again, in 1937, make a great social contribution to the nation's progress.

In at least 160,000 rural and farm homes electric service will bring for the first time the improved vision, the proper protection of food, the proper preparation of food, the comfort of modern living conditions—in short, the increased standard of living which follows in the train of electric service.

The rate at which homes will be connected to the lines in 1936 and 1937 far exceeds the rate of 1935, is twenty times the rate of 1933. By the end of 1937 it may well be that 33 per cent of the farms will be receiving electric service, this figure being based

Construction of Rural Lines Reported

Cost in Dollars

		Private Utilities			Municipal	
No.	Region	1936	1937	No.	1936	1937
36	New England	$777,731	$654,025	29	$21,626	$36,400
43	Middle Atlantic	5,805,441	6,916,023	22	13,100	15,510
39	East No. Central	4,937,774	4,535,341	62	325,875	956,850
37	West No. Central	1,316,440	1,301,400	55	917,450	383,600
17	South Atlantic	3,132,806	2,611,350	22	211,200	167,500
11	East So. Central	311,595	346,000	10	12,300	122,500
24	West So. Central	1,042,328	1,492,500	6	1,800	8,500
31	Mountain	428,869	557,550	10	31,590	38,500
13	Pacific	810,565	784,800	10	9,300	6,000
251		$18,563,549	$19,198,989	226	$1,544,241	$1,735,360

Length in Miles

		Private Utilities			Municipal	
No.	Region	1936	1937	No.	1936	1937
36	New England	558	482	29	18	27
43	Middle Atlantic	4,262	5,033	22	15	15
39	East No. Central	4,735	4,305	62	380	549
37	West No. Central	1,261	1,230	55	870	413
17	South Atlantic	2,673	2,356	22	243	192
11	East So. Central	309	325	10	23	130
24	West So. Central	1,168	1,585	6	2	15
31	Mountain	426	564	10	46	55
13	Pacific	651	701	10	10	6
251		16,053	16,581	226	1,607	1,402

on the total farms with improvements valued at $500 or more.

Of course, the construction of rural lines to serve one-third of the farms presents its own set of problems. Hand in hand with these is another set presented by the job of making these rural lines begin to pay their way.

With farm income one billion dollars over last year, the farm and rural customer has been cooperating in solving the riddle of rural investment versus rural revenue.

In 1936 the company invested $193 per customer in new lines and $73 per customer in meters, services and transformers, a total of $266 per customer. The customer, on the other hand, has put in a $69 wiring job and spent $141 for appliances, a total of $210.

This combined investment of $476 presents a challenge, for the average bill is only $4 per month, $48 per year. Provided an operating ratio as favorable as 50 per cent can be applied to rural business, there is $24 per year left for interest, depreciation and taxes on $266 of investment.

The company problem is to increase the revenue by increasing usage, so that the present lines may become self-supporting. Then the company is in a position to advance upon the construction of other lines.

The record of R.E.A.

The record of R.E.A., shown in the adjoining table, presents data of interest to all groups endeavoring to advance the progress of rural electrification. This table of allotments (as contrasted with actual expenditures mentioned on preceding pages) indicates that a total of $42,903,079 has been earmarked for the construction of 38,513 miles of rural line to serve 136,659 customers.

As a result, it would appear that the Rural Electrification Administration projects will serve 3.54 customers per mile and cost $1,111 per mile. Due to R.E.A. procedure, the same interpretation can not be placed on the cost-per-mile figure as is customary in the utility industry. This is explained in ELECTRICAL WORLD, November 28, 1936, page 5. Particular attention is merited by the figure of 3.54 customers per mile, for it shows, among other things, that the farm situation presents as much of a problem to the administrator of taxpayers' funds as it does to the utility administrator of stockholders' funds.

The average may be broken down, and broken down in the light of R.E.A. experience on lines actually constructed. For example, in Florida 66.3 miles are to serve 267 customers, about 4.03 per mile. In Georgia 102.5 miles are to serve 350 customers, about 3.4 per mile. In Illinois project 7 shows a ratio of 2.47 customers per mile.

Selected R.E.A. projects

Among the largest R.E.A. projects constructed this year the following examples are selected to show some of the actual conditions met by R.E.A. All figures are round numbers.

The $260,897 project in Iowa cost $1,110 per mile (without meters) and is to serve 1.61 customers per mile.

The $243,810 Shelby County project in Ohio cost $900 per mile and is to serve 3.7 customers per mile. The $407,265 project in Champaign County, also in Ohio, cost $925 per mile and is to serve 4.4 customers per mile.

Texas project 21 cost $252,596, resulted in 361 miles at $700 per mile, to serve 3.32 customers per mile.

A large project in Nebraska (number 44) cost $342,991, or $900 per mile, and is to serve 3.05 customers per mile.

R.E.A.-Financed Projects Totaled by States, as of December 7, 1936

Line Construction

State	No. Projects	Amount Allotted	No. Miles	No. Customers
Alabama	3	$235,400	228.7	1,091
Alaska	1	115,000	80	292
Arizona	1	145,000	124	509
Arkansas				
California	2	1,060,000	984	2,782
Colorado	1	140,000	139	638
Connecticut				
Delaware	1	405,000	385	1,201
Florida	2	213,000	244.1	696
Georgia	13	1,572,000	1,480	7,914
Idaho	2	208,750	178.5	765
Illinois	7	1,399,500	1,320	4,840
Indiana	15	4,564,926	4,402	15,659
Iowa	21	3,302,117	3,511.6	10,631
Kansas	2	260,000	245	809
Kentucky	2	261,700	191.7	1,484
Louisiana				
Maine	1	60,000	61.5	386
Maryland	1	165,000	156	527
Massachusetts	1	255,000	232	680
Michigan	1	400,000	350	1,975
Minnesota	16	2,989,000	2,909	9,292
Mississippi	3	216,600	188.7	833
Missouri	9	1,714,000	1,687.1	5,833
Montana	7	650,000	621.8	2,180
Nebraska	12	$3,722,650	3,477	9,054
Nevada				
New Hampshire				
New Jersey				
New Mexico	1	56,000	58	277
New York				
North Carolina	7	1,314,250	1,119.9	6,124
North Dakota	1	96,000	51	265
Ohio	11	4,045,000	3,417	13,059
Oklahoma	6	1,195,000	1,316	3,355
Oregon				
Pennsylvania	5	1,525,000	1,380.8	3,351
South Carolina	2	648,328	507	2,548
South Dakota	1	77,000	67	320
Tennessee	6	1,070,758	1,029	4,741
Texas	8	1,949,000	1,797	6,448
Utah				
Vermont				
Virginia	6	1,619,800	1,499.3	6,045
Washington	4	548,000	469	1,491
West Virginia				
Wisconsin	16	4,679,600	2,518.5	8,276
Wyoming	2	94,000	87	288
Total	200	$42,903,079	38,513.2	136,659

House and Farm Wiring

	No. Projects	Amount Allotted
Minnesota	1	$25,000
Ohio	1	30,000
Total	2	$55,000

Increasing Generating Capacity

	No. Projects	Amount Allotted
Iowa	1	$75,000
Total	1	$75,000
Grand total		**$43,033,079**

Rising Barometers

BUSINESS is definitely on its way back and will continue to improve in 1937! That, briefly, is the panorama presented on these two pages, in twelve charts incorporating the results of studies made by various McGraw-Hill technical publications. From a lowest point in 1932 (1933 for construction) these business indexes have risen—more or less sharply—until many have now reached or even exceeded their 1929 peaks.

Herewith is presented a brief summary of the improved business outlook among the charted industries, the rise and fall of which is significant—in varying degrees—to the electrical industry.

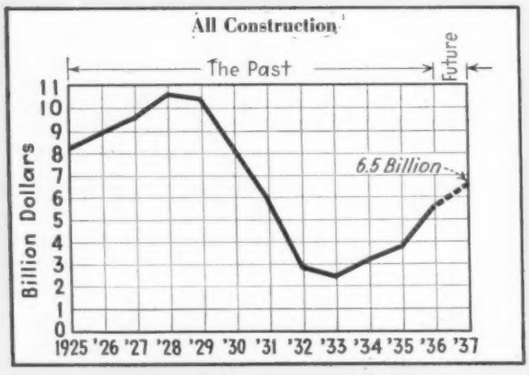
A total of $6,500,000,000 of construction in 1937, at least one-half of which would be undertaken by private enterprise, is a hoped-for estimate and represents a 20 per cent increase over 1936. The physical volume of all construction in 1936 was estimated at 80 per cent of 1926 or 1931, 60 per cent of 1929. While construction is behind many other industries, it is regarded by observers as being in a sounder condition to advance than at any time in recent years.

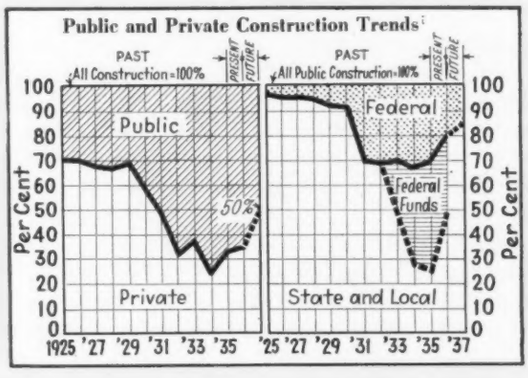
The index of industrial machinery sales indicates the rapid improvement in the machinery industries. This curve reached 190—on the basis that an average month for 1935 equals 100—in June, 1936. It is believed that the present level of activity will be maintained and should be considerably improved in 1937.

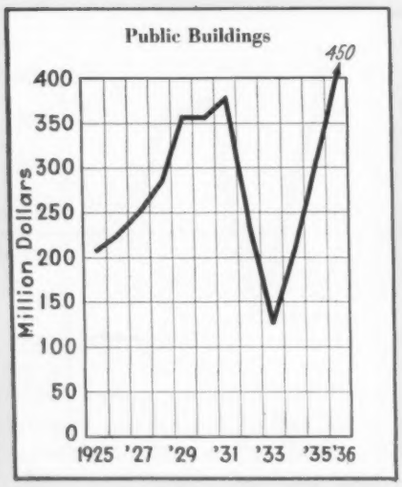
Two curves depict the trends among metals. Considerable prosperity is predicted for the copper industry, there being indications of an increase in production and a slightly higher price for the coming year. Steel mills have been operating at about 70 per cent capacity and will likely hold at that rate, although they may rise to 80 per cent. Iron ore production can be speeded up at any time to meet the demand for steel.

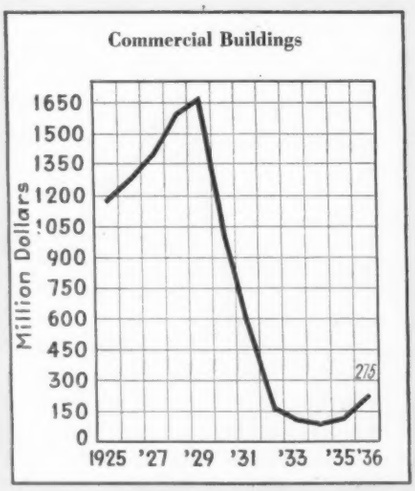
Capital goods, usually parallel to consumer goods, suffer most from the blow of depression, but rise abruptly when the upturn comes. This is happening now. Furthermore, during normal times, the relationship between employment and payrolls is usually well fixed. The gap between these, which developed in 1930 and then widened, is now closing.

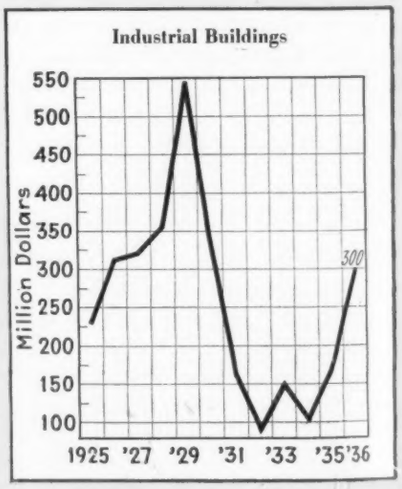
The index of sales of machinery and supplies to the textile industry places 1936 sales equal to those of 1929; this increased activity (the index stood at 39 in 1932) should continue this year. Finally, the composite average for fourteen process industries should reach 127 in 1937; it was 100 in 1929.







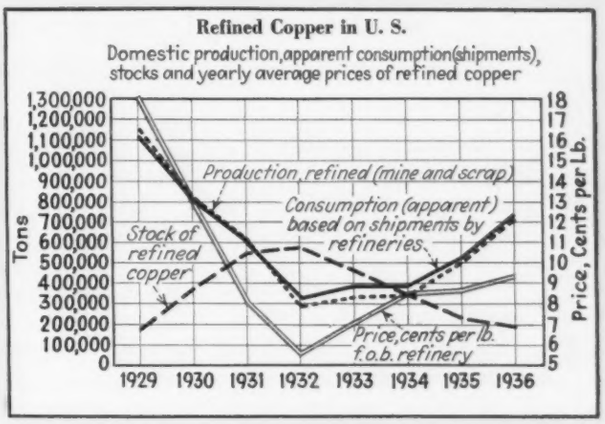


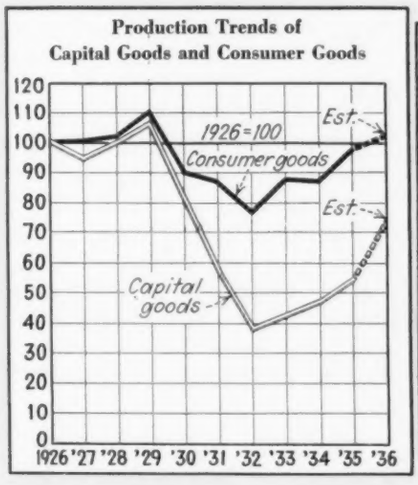


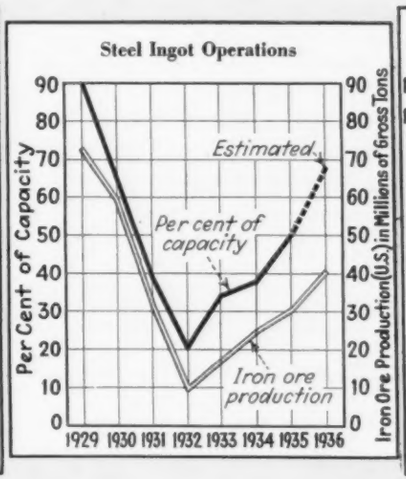
Indicate Fair Weather for Industry

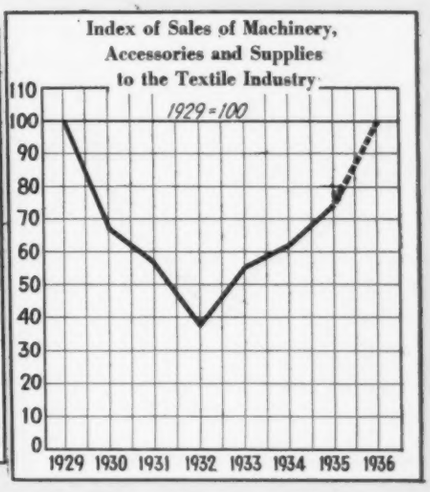
Several industries outdo 1929
Construction rising at sound rate
Capital goods accelerate

Index of Industrial Machinery Sales
Factors: Machine tools, Electric motors, Stokers, Foundry equipment, Woodworking machinery, Air conditioning equipment, Industrial pumps
Average month 1935=100
1926 '27 '28 '29 '30 '31 '32 '33 '34 J F M A M J J A S O N D J F M A M J J A
1935
1936

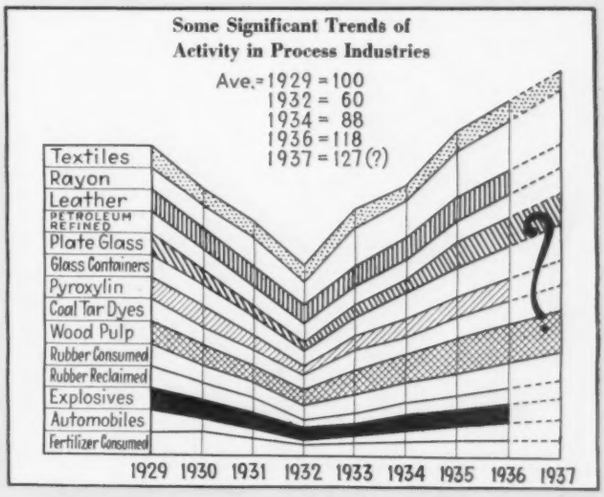

Refined Copper in U. S.
Domestic production, apparent consumption (shipments), stocks and yearly average prices of refined copper
Tons
Price, Cents per Lb.
Production, refined (mine and scrap)
Consumption (apparent) based on shipments by refineries
Stock of refined copper
Price, cents per lb. f.o.b. refinery
1929 1930 1931 1932 1933 1934 1935 1936




Steel Ingot Operations
Per Cent of Capacity
Iron Ore Production (U.S.) in Millions of Gross Tons
Estimated
Per cent of capacity
Iron ore production
1929 1930 1931 1932 1933 1934 1935 1936


Index of Sales of Machinery, Accessories and Supplies to the Textile Industry
1929=100
1929 1930 1931 1932 1933 1934 1935 1936

Manufacturing Industries—Employment and Payrolls
1923-25 = 100
Employment
Payrolls
1919 '20 '21 '22 '23 '24 '25 '26 '27 '28 '29 '30 '31 '32 '33 '34 '35 '36



Manufacturers' Sales Increase 33 per Cent

Value of Electrical Products $1,190,000,000 in 1936 and Estimated to Reach $1,500,000,000 in 1937 — Effect of Increasing Utility Service Facilities Seen — All Lines Show Improvement

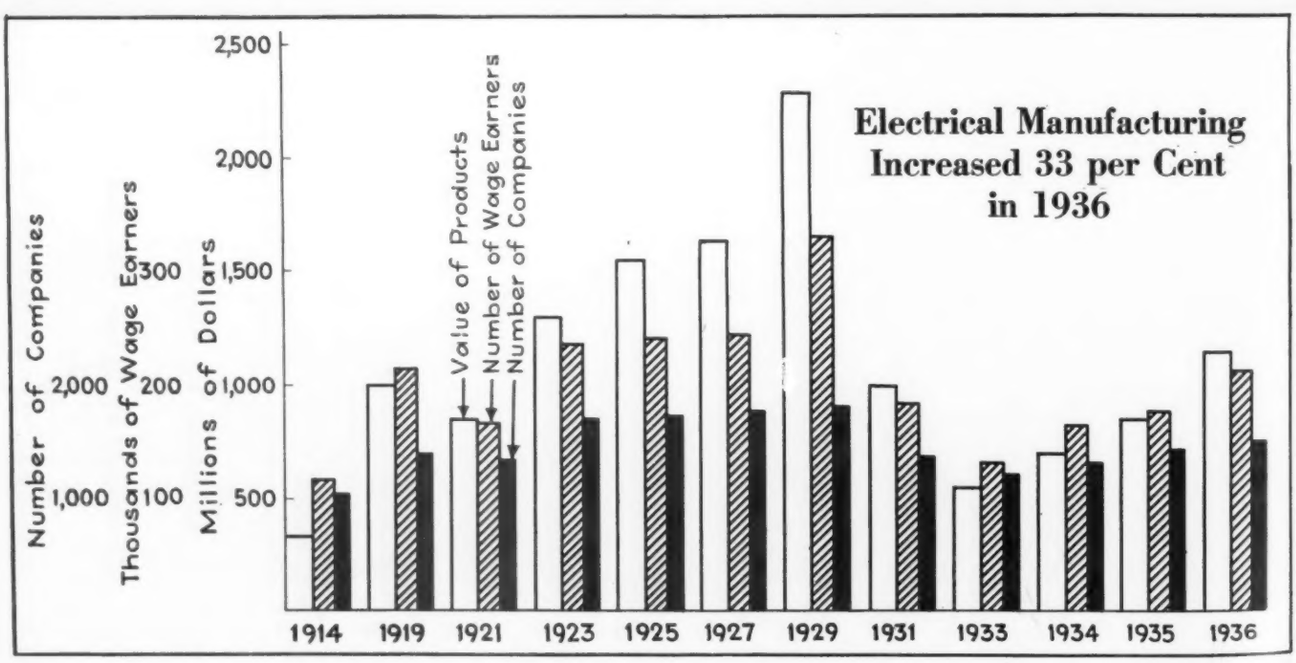
WHILE the output of electrical products is still below the boom peak, the increase in sales over the previous year, 33 per cent, has all the earmarks of a boom period. Once more the value of electrical manufacturers' output, based upon the "value of product" classification of the census, has passed the billion-dollar mark. This "factory value," which excludes sales expense, is estimated to have been $742,000,000 in 1934, $897,000,000 in 1935 and $1,190,000,000 for 1936. With an anticipated increase of 25 per cent in 1937, this figure will stand for the new year at $1,500,000,000, or 65 per cent of the 1929 peak as to value.

The curve of orders booked by electrical manufacturers, based on reports of the U. S. Department of Commerce, however, shows an even better picture. The latter part of 1936 showed bookings to be comparable with those in the 1926-1928 period, giving confidence to the belief that 1937 bookings should closely approach the 1929 peak. In fact, it is easily possible that 1937 orders will considerably exceed the anticipated 25 per cent increase.

Already a sellers' market has developed in a number of products. Deliveries are lengthening and this condition is expected to become more pronounced as the year advances. In fact, there is good reason to believe that in many instances the volume of business by electrical manufacturers this year will be limited only by their ability to produce.

Another factor which is expected to raise the total of dollar volume is a higher price level.

The demand for electrical products has gone ahead in every direction. Major equipment sales, for instance, are estimated to have reached a total of $405,500,000 in 1936, with a 24 per cent predicted gain to $503,810,000 for 1937. These figures reflect the



Appliance Sales in 1936

(Retail Values)

Refrigerators	2,080,227	$362,000,000
Radio sets	6,900,000	285,000,000
Incandescent lamps (large)	460,000,000	102,000,000
Electric washers ...	1,500,000	101,000,000
Electric ironers	180,000	10,000,000
Electric ranges	318,000	41,000,000
Vacuum cleaners ...	1,135,000	65,000,000
Water heaters	104,000	7,600,000
		$973,600,000

demand on the part of the light and power industry for additional generating plant and distribution requirements to meet the rapidly increasing consumption of power.

Not only is the power industry in the market for equipment, but the industrials also are buying more. New plants, modernization, more mechanization, combined, have created a demand for electrical products which, if it has not already established a new high for industrial electrical products, will do so soon. The used equipment market, glutted two or three years ago, has already been well depleted.

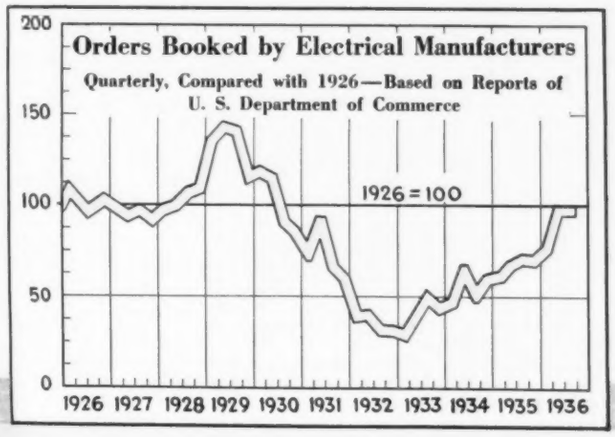
Other factors which contributed to the 1936 increase and will be larger factors in 1937 are rural electrification and new building construction. Added to the utility program will be a much greater R.E.A. activity.

New building, the last of the major markets to come back, is now making rapid headway and can be expected to absorb a substantially larger volume of electrical products in 1937. The interesting part of this market is the larger electrical requirement per building over what it was ten years ago. Building modernization can also be expected to require more electrical products, particularly in wiring, lighting and air conditioning.

The appliance market apparently knows no bounds. While the values given in the accompanying table are retail values based upon nine and ten months production, their very size is breathtaking. One of the interesting figures is that for ranges. Not only has it neared the third-of-a-million mark in number of units, but each unit means the sale of other electrical material. Ranges are emerging from the market pioneering stage and securing wider distribution through dealers, thereby insuring a much more rapid market expansion and, incidentally, inviting the participation by other manufacturers. And the baby—water heaters—is beginning to travel in big company.

The load-building activities of the power companies and the co-operative market development programs of the industry can be expected to increase these totals materially.

The table of earnings of a number of representative electrical manufacturers is included as further evidence of the remarkable improvement which the industry is enjoying.


Orders Booked by Electrical Manufacturers
Quarterly, Compared with 1926—Based on Reports of U. S. Department of Commerce
200
150
100
50
0
1926 = 100
1926 1927 1928 1929 1930 1931 1932 1933 1934 1935 1936

Net Incomes Continue to Rise

	Nine Months Ended Sept. 30 1935	1936
Allis-Chalmers	1,374,919	3,580,813
Anaconda Wire & Cable	681,232	1,679,968
Carrier	25,914*	161,470*
Century Electric		127,261*
Crocker Wheeler ...	19,975*	22,508*
Cutler Hammer		980,553
Fairbanks Morse ...	376,990*	786,614*
General Cable.....	(d) 81,345	835,321
General Electric ...	17,205,332	26,533,667
Kelvinator	778,583	1,372,883
Maytag	1,928,000	2,184,099
Radio Corporation of America	2,289,136*	1,763,780*
Sangamo Electric ..	272,091	672,962
Square D	448,246	593,823
Westinghouse	8,822,640	11,123,706
Weston	154,967	161,470

(d) Deficit. * Six months ended June 30.
Data by courtesy of Standard Statistics Co.

Estimates of Major Product Sales in 1936 and 1937

Class of Products	1936	1937	% Increase
A.C. generators, including generator end of prime movers	$37,500,000	$52,500,000	40
Synchronous condensers and frequency changers	3,600,000	4,080,000	30
Motor-generator sets	7,400,000	9,250,000	25
Distribution transformers 1.5 to 500 kva.	25,000,000	32,000,000	28
Power transformers 500 kva. and up.	15,500,000	21,000,000	35
Instrument transformers	3,000,000	3,700,000	23
Induction motors, polyphase and single phase 1 hp. and over	50,000,000	60,000,000	20
Fractional-horsepower motors	40,000,000	50,000,000	25
Synchronous motors	4,500,000	5,500,000	22
Switchboards and accessories	16,500,000	19,500,000	18
Metal inclosed switchgear	4,800,000	5,400,000	12
Circuit breakers *			
Oil	11,000,000	13,200,000	20
Air	1,600,000	2,080,000	30
Disconnect switches *	4,000,000	5,000,000	25
Knife switches *	1,600,000	2,000,000	25
Meters *	22,000,000	24,500,000	11
Arresters	3,600,000	4,500,000	12.5
Induction regulators *	2,500,000	3,500,000	40
Furnaces, industrial	5,000,000	7,500,000	50
Industrial heating devices, other than ovens and furnaces	4,000,000	5,600,000	40
Welding apparatus and supplies	13,400,000	17,500,000	40
Industrial control	33,000,000	40,000,000	20
Conduit and fittings	44,000,000	53,000,000	20
Insulators *	2,000,000	2,500,000	12.5
Cable, underground	50,000,000	60,000,000	25
	$405,500,000	$503,810,000	24
Total electrical manufacturing business — based on U. S. Census classification	$1,190,000,000	$1,500,000,000	25

* Not included in switchboards.

* Not included in switchboards.

Trends in Industrial Modernization

Electric Furnaces and Ovens

Controlled atmospheres possible with electric furnaces have opened new opportunities for safe processing and superior product quality. Ease and accuracy of temperature control, safety, cleanliness and low cost have influenced the trend to electric heating. Improved metallic elements are making it possible to reach high electric furnace temperatures without going to arc furnaces. Ability to reproduce furnace heats to permit product duplication has enhanced the value of electric heat-treating furnaces.

Welding

Modern industry has accepted welding as a necessary production tool. Use of welding in the fabrication of products effected savings in time, material, labor and weight. Automatic controls for welding machines are in use that permit exact duplication of satisfactory welds. Welding work too large or too heavy to be carried to stationary spot welders is now reached with spot welding "guns" easily carried about.

Motors

Rugged construction and reliability are being built into newer motors. More and more of them are going outdoors to facilitate construction and other outdoor operations. The attached motor is yielding to the built-in type. Widespread attention is being given to adjustable-speed motors by industrials.

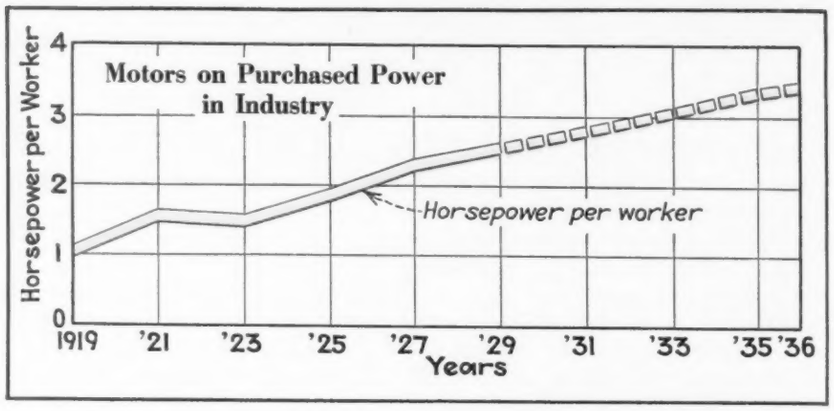
Control

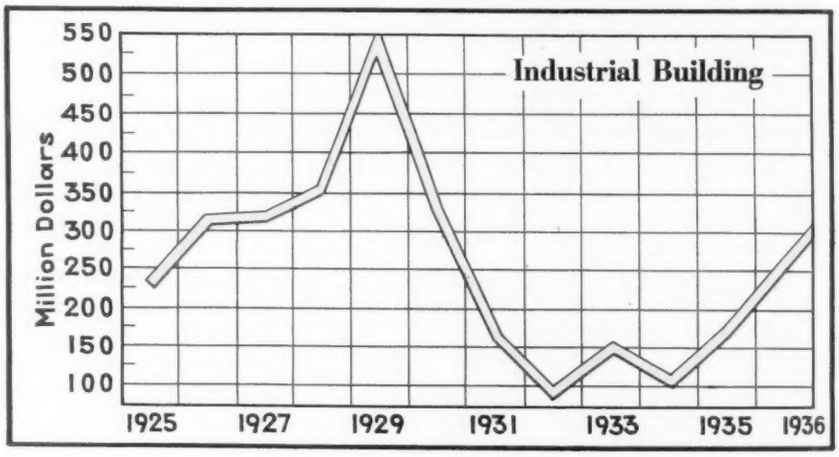
Significant among current trends in industrial control is a movement toward use of centralized unit panels for housing a number of contactors and motor starters apart from the controlled equipment, use of angle switching controls to avert cumulation of peaks with synchronous motor-driven reciprocating machines, time-cycle controls for the regulation of industrial processes involving repetitive cycles of seconds or minutes. Automatic sequence starting of motors is being used to reduce current inrush and demand. Improved motor protection is being obtained with starters featuring interchangeable thermal overload protection relays, current or time-limit acceleration or oil-immersed overload protection.

Industrial Wiring

Emphasis in industrial wiring systems is being placed on flexibility—flexibility to permit expansion, flexibility that will permit ready relocation of machines and flexibility to allow optimum use of existing equipment. Trolley schemes are being used for serving high-frequency and other tools on production lines. Bus-type distribution systems are expanding.

Industry Extends





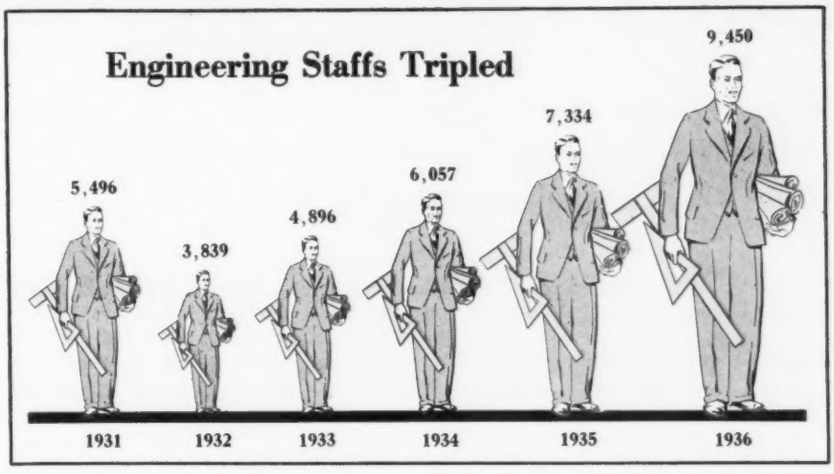
INDUSTRY is rebuilding and modernizing its production facilities. Curves so long turned down point up once more. Obsolescence, that during the past six years has outpaced replacement and modernization, is being offset by a period of widespread improvement, in which electrification is playing an increasingly important role.

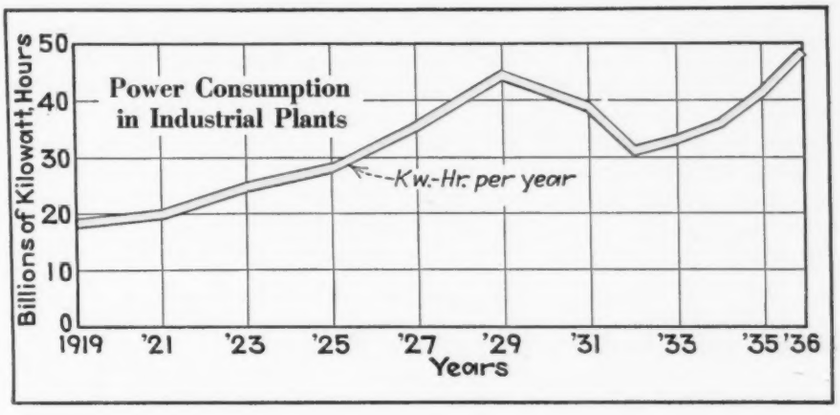
The present revival of industrial construction and modernization began seriously in 1934. In the last six months of that year the investment in industrial building rose from $100,000,000 to about $135,000,000. During 1935 it reached a total of approximately $215,000,000, and at this writing, with but two weeks remaining in December, the amount of proposals reported in ELECTRICAL WORLD from week to week during the year has reached the total of $307,955,000. Inasmuch as this figure includes the cost of projects for which plans have been announced but on which construction has not been started, a portion of this total may be carried over into 1937.

The above figure of $307,955,000 represents investments in new plant buildings, extension of existing buildings, the cost of purchasing and installing modern processing equipment, up-to-date production tools and a general strengthening of plant facilities. It thus appears that about $60,000,000 has been spent for electrical equipment—motors, controls, transformers and accessories, revamped industrial wiring, modern machine drives, electric hoists, conveyors, elevators, process control instruments, electric furnaces and other similar equipment.

As a result of this activity, revitalized, awakened industry is using more power than in former years and

Electrification





more power in relation to product output. The trend in industrial energy consumption, as indicated by power purchased from utility companies, is indicated by the accompanying chart. A total industrial consumption of 49,050,000,000 kw.-hr. is indicated for 1936. This represents an increase of 11 per cent over the peak year of 1929, when industry purchased only 44,326,000,000 kw.-hr.

Further evidence of electrification in industry is to be noted in the fact that the horsepower of industrial electric motors on purchased power has increased from 2.58 per worker in 1929 to 3.43 hp. per worker in 1936. This is an increase of 33 per cent. There has been an increase of 226 per cent since 1919, as is indicated by the accompanying chart. Data for this curve were obtained from the U. S. Census of Manufactures for the years 1919 to 1929. No figures have been compiled by the census since that date. The figure of 3.43 hp. per worker for 1936 was obtained on the assumption that the horsepower of electric motors on purchased energy in industry in 1929 and 1936 was proportional to the kilowatt-hours of energy purchased by industry during those years. This assumes that the energy consumption per horsepower was the same for 1929 and for 1936.

In addition to the expansion of plant facilities industry has strengthened and increased its engineering staffs. Since 1932 there has been a steady growth in the number of product designers, research workers, experimental engineers and draftsmen employed. This year 315 manufacturers reported an average increase of 29 per cent, which is the biggest increase since 1932. The trend of employment of engineers in industry is shown pictorially on this page.

$308,000,000 for Construction, Modernization

Expenditures for planned construction expansion and modernization of industrial plants that were announced during the year 1936. Data compiled from the Sales Opportunities section of the ELECTRICAL WORLD.

Bethlehem Steel Co.	$41,000,000
Tenn. Coal, Iron & Railroad Co.	25,000,000
Amer. Sheet & Tin Plate Co.	25,000,000
Jones & Laughlin Steel Corp.	25,000,000
Standard Oil Co. of Indiana	10,000,000
Ontario Paper Co.	8,500,000
Southern Kraft Corp.	7,500,000
Youngstown Sheet & Tube Co.	7,350,000
Industrial Rayon Corp.	7,000,000
Continental Can Co.	7,000,000
General Motors Corp.	6,500,000
Republic Steel Corp.	5,750,000
Container Corp. of America	5,500,000
Tubize Chatillon Co.	5,300,000
Carnegie-Illinois Steel Corp.	5,000,000
West Virginia Pulp & Paper	5,000,000
Fisher Body Corp.	5,000,000
Lever Bros. Co.	5,000,000
Olds Motor Works Inc.	5,000,000
Kieckefer Container Corp.	4,000,000
Champion Paper & Fiber Co.	3,000,000
Monsanto Chemical Co.	3,000,000
Crown Cork & Seal Co.	2,750,000
Union Bag and Paper Corp.	2,500,000
Wisconsin Steel Works	2,500,000
Atlantic Refining Co.	2,000,000
Owens-Illinois Pacific Coast Co.	2,000,000
Soundview Pulp Co.	2,000,000
Kraft-Phenix Cheese Corp.	2,000,000
Johns-Manville Corp.	1,950,000
Ludlow Mfg. Associates	1,500,000
Shell Petroleum Corp.	1,500,000
Linde Air Products Co.	1,500,000
Spreckles Sugar Co.	1,500,000
Standard Oil Co. of Ohio	1,500,000
Buick Motor Co.	1,500,000
Viscose Co.	1,200,000
Industrial Rayon Corp.	1,200,000
Ford Motor Co. of Canada	1,200,000
Armour & Co.	1,100,000
Holly Sugar Co.	1,100,000
Garford Co.	1,000,000
Atlas Powder Co.	1,000,000
Petrol Refining Co.	1,000,000
Cyclops Steel Co.	1,000,000
Butler Bros.	1,000,000
DuPont Rayon Co.	1,000,000
Carbide & Carbon Chemical Corp.	1,000,000
Postum Co.	1,000,000
Solvay Process Co.	1,000,000
International Nickel Co.	1,000,000
Technicolor Inc.	1,000,000
Union Carbide Co.	1,000,000
Kendall Refining Co.	1,000,000
Socony Vacuum Oil Co.	1,000,000
Eastman Kodak Co.	1,000,000
Owens-Illinois Glass Co.	1,000,000
Crowell Publishing Co.	1,000,000
Rahr Malting Co.	1,000,000
National Dairy Products Corp.	1,000,000
General Dyestuff Corp.	1,000,000
Sheffield Farms Co.	900,000
Studebaker Pacific Corp.	850,000
Bendix Aviation Corp.	800,000
International Harvester Co.	800,000
Celanese Corp. of America	750,000
Utah-Idaho Sugar Co.	750,000
Chevrolet Motor Co.	750,000
Pure Oil Co.	700,000
Mesta Machine Co.	700,000
Libby-Owens Ford Glass Co.	700,000
Ralston Purina Co.	700,000
Electro-Motive Corp.	700,000
Grand Rapid Vanish Corp.	600,000
Ford Motor Co.	500,000
Chapman Price Steel Co.	500,000
Campana Corp.	500,000
General Phosphate Co.	500,000
Pontiac Motor Co.	500,000
General Motors Truck Co.	450,000
Jefferson Lake Oil Co.	450,000
United Aircraft Corp.	400,000
Cudahy Packing Co.	400,000
Universal Atlas Cement Co.	400,000
Lockheed Aircraft Corp.	400,000
L. A. Young Spring & Wire Corp.	400,000
Hammermill Paper Co.	350,000
Sunshine Mining Co.	350,000
Climax Molybdenum Co.	350,000
George A. Weston Co.	300,000
	$290,350,000
And 115 others totaling	$307,955,000

Government Power Projects Aggregate $1,300,000,000

Boulder and Grand Coulee the Largest, Ultimately to Develop 4,500,000 Hp. — Local Projects Allotted $90,000,000 by the P.W.A., $43,000,000 by the R.E.A.

POWER projects now in process of development and involving the use of federal funds will cost about $1,300,000,000. That is putting it into round numbers, but since no one can accurately predict the price changes that may occur before they have been completed, there is little virtue in trying to give exact figures. A large portion of that sum, though not all of it, will ultimately constitute a permanent outlay by the federal government; the chief exceptions are municipal projects financed in part by P.W.A. loans and rural lines built under loan contracts with R.E.A.

Appropriations to date amount to somewhat more than half the estimated ultimate cost, but the proportion varies widely among the different projects. This vast sum is being administered by a number of different agencies. To get a composite picture, the information has to be collected from these several sources, in so far as it is to be had at all in usable form.

There is the T.V.A., to develop 573,400 hp. at a cost of $220,000,000 if the whole cost of Wilson Dam is included, or $195,000,000 if we count only the $22,000,000 charged to power. Three-fourths of the amount has been appropriated. Four projects, from Maine to Washington State, are under the Corps of Engineers. Among them is Passamaquoddy, on which $6,500,000 was spent before operations were suspended. Appropriations cover three-quarters of the estimated cost of $178,000,000. Though highly publicized, none of these plants is as large as those on the lower Susquehanna River.

The really big projects are in the hands of the Bureau of Reclamation —Boulder Dam and Grand Coulee. Assuming that the "high dam" development at the latter site is eventually carried out, the prospective capacity will be 2,700,000 hp., at a cost of $376,631,000, of which $178,790,000 is the portion charged to power. The

Summary of Federal or Federally Aided Power Projects

	Appropriated to Date	Total Cost
Tennessee Valley Authority	$150,900,000	$219,650,748
Corps of Engineers	141,056,550	177,784,800
Bureau of Reclamation	191,234,000	731,631,000
Public Works Authority	90,733,253	100,000,000 [2]
Rural Elec'n Administration	43,033,079 [1]	43,033,079
Total	$616,956,882	$1,272,099,627

[1] Allotments of loans to full value of projects.
[2] Assumed for arriving at grand total.

Tennessee Valley Authority

Projects	Initial Power Installation	Appropriated to date	Total Cost
Wilson	261,400 hp.	[1]	46,950,748 [2]
Norris	132,000 hp.	.....	36,000,000
Wheeler	90,000 hp.	.....	33,000,000
Pickwick Land'g	90,000 hp.	.....	26,700,000
Guntersville	0	.....	29,400,000
Chickamauga	0	.....	31,600,000
Hiwassee	0	.....	16,000,000
Total	573,400 hp.	$150,900,000	219,650,748

Corps of Engineers

	Initial Power Installation	Appropriated to date	Total Cost
Fort Peck	67,000 hp.	$89,391,000	$108,600,000
Bonneville	115,000 hp.	44,015,700	51,000,000
Passamaquoddy	44,800 kw.	7,000,000 [4]	6,500,000 [4]
Bluestone Res'r	Undetermined	649,850	11,684,800
Total	226,800	$141,056,550	$177,784,800

[4] Approximately $500,000 unexpended balance will be returned to Treasury, making cost to date, $6,500,000. Project now suspended.

Bureau of Reclamation

	Initial Power Installation	Appropriated to date	Total Cost
Boulder Dam	1,835,000 hp.	$115,260,000	$126,500,000
All-American Canal	18,500 kw.	27,000,000 [5]	38,500,000
Grand Coulee	2,700,000 hp.	20,750,000	376,631,000 [3]
Caspar-Alcova	24,000 kva.	13,227,000	20,000,000
Central Valley	Undetermined	15,000,000	170,000,000
Total	4,577,500 hp.	$191,234,000	$731,631,000

[1] Total T.V.A. appropriations $150,900,000. This is not allocated to specific projects. [2] Total cost. Charge to power, $22,000,000.
[3] Total cost, high dam. Charge against power, $178,790,000.
[5] Of which $2,760,000 is for power development.

Allotments for Power Projects

State	P.W.A.	R.E.A.
Alabama	$2,611,726	$235,400
Alaska	166,000	155,000
Arizona	33,500	145,000
Arkansas	190,000	.....
California	4,604,795	1,060,000
Colorado	220,500	140,000
Connecticut	450	.....
Delaware	33,500	405,000
Florida	1,111,415	213,000
Georgia	85,039	1,572,000
Idaho	399,445	208,750
Illinois	1,861,528	1,399,500
Indiana	452,384	4,564,926
Iowa	654,363	3,302,117
Kansas	666,034	260,000
Kentucky	230,650	261,700
Louisiana	.....	.....
Maine	.....	60,000
Maryland	.....	165,000
Massachusetts	105,375	225,000
Michigan	1,758,456	400,000
Minnesota	770,786	2,989,000
Mississippi	283,080	216,600
Missouri	1,023,915	1,714,000
Montana	.....	650,000
Nebraska	22,020,872	3,722,650
Nevada	658,570	.....
New Hampshire	5,575	.....
New Jersey	184,500	.....
New Mexico	.....	56,000
New York	1,852,594	.....
North Carolina	2,874,800	1,314,250
North Dakota	40,600	96,000
Ohio	2,730,697	4,045,000
Oklahoma	564,485	1,195,000
Oregon	63,636	.....
Pennsylvania	433,514	1,525,000
Rhode Island	93,800	.....
South Carolina	8,852,000	648,328
South Dakota	94,608	77,000
Tennessee	7,044,112	1,070,758
Texas	19,834,608	1,949,000
Utah	60,658	.....
Vermont	3,600	.....
Virginia	1,660,054	1,619,800
Washington	3,206,119	548,000
West Virginia	900	.....
Wisconsin	190,010	4,679,600
Wyoming	.....	94,000
Total	**$90,733,253**	**$42,903,079**
Miscellaneous		130,000
R.E.A. Total		**$43,033,079**

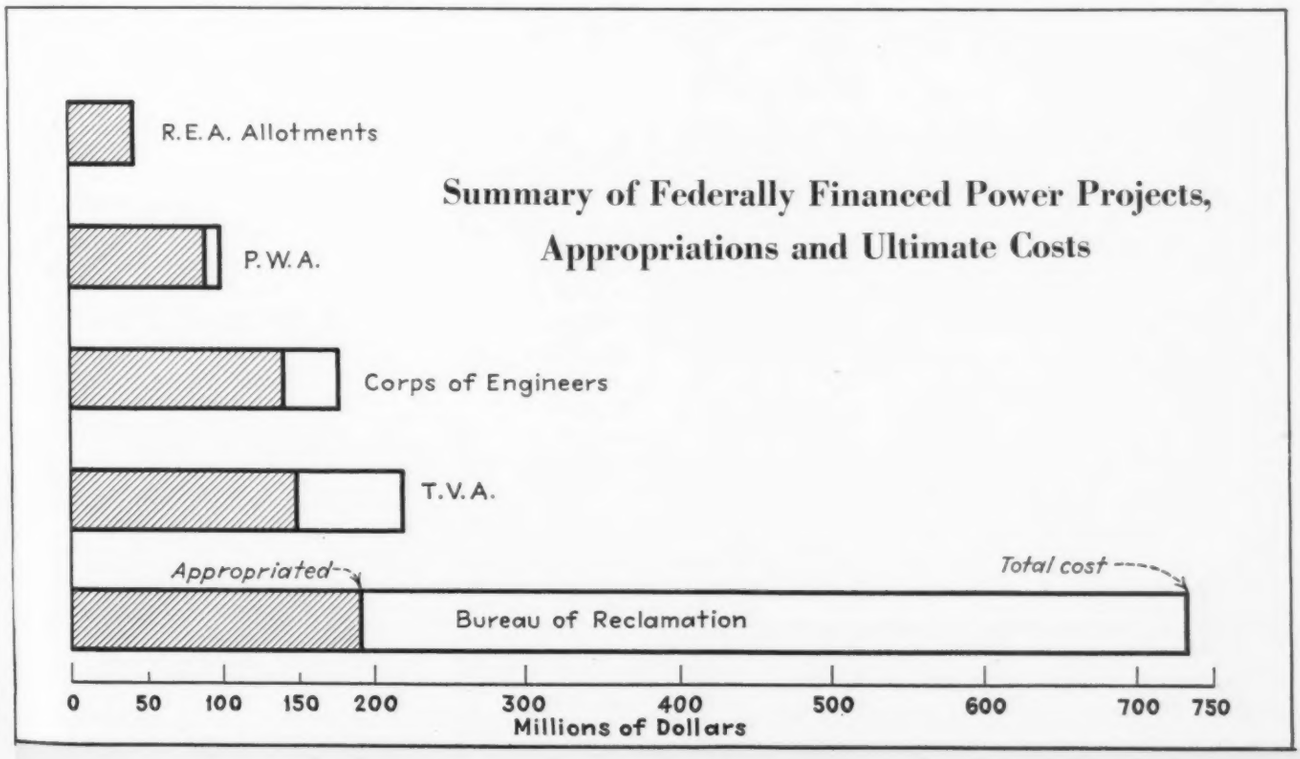
cost of the five Bureau of Reclamation projects, to develop about 4,500,000, is estimated at $732,000,000.

The effect of these great developments on privately owned companies in their vicinity, on the well-being of the people in the regions served by them and on the taxpayers whose money is being used to build them will depend largely on administrative policy regarding their operation. There is no inherent reason why the interests of these three parties should be antagonistic. Non-political operation, adequate returns on the investment and mutual fairness may be a difficult ideal, but not an impossible one.

These federal projects call for a total development of 5,330,000 hp., excluding Passamaquoddy, on which construction has been suspended. The present total for all public utility plants is about 36,600,000 kw.; prime movers may be taken at 51,000,000 hp. This the new federal plants will increase by more than 10 per cent.

It will be noted that the major projects are concentrated in the Southeast and the far West. In the East South Central division the Federal Power Commission reports 1,773,859 kw., or, say 2,500,000 hp., now in operation. The T.V.A. program will increase this by 23 per cent. In the Rocky Mountain and Pacific States the present total is 5,731,508 kw. or approximately 8,000,000 hp. Boulder, Bonneville and Grand Coulee (high dam) aggregate 4,650,000 hp. and will, therefore, add more than 50 per cent to present capacity.

In contrast with these huge undertakings are those of the P.W.A. Power Division. As of November 1, 1936,



Status of Rural Project Development as of November 15, 1936

	E.R.A. Act Of April 8, 1935	R.E.A. Act 1936 (R. F. C. Funds)	Total
194 Allotments approved	$14,995,029	$24,868,550	$39,863,579
96 Loan contracts executed	13,537,629	8,085,000	21,622,629
74 Projects with specifications approved, under construction or completed	12,452,429	4,047,400	16,499,829
20 Projects energized in whole or in part	4,613,079	.....	4,613,079

P.W.A. had made 287 allotments for local power projects aggregating $90,733,253 scattered throughout the country, as appears from the table giving the amounts by states. It is difficult to ascertain the estimated cost of the projects on which this money is to be spent. Allocations include outright grants, some at 30 and some at 45 per cent, loans, and combinations of these. Hence, the allotment may or may not indicate the full cost of the project. Further, some institutional plants, as in hospitals, are included in the state totals. Taking account of all these elements, the total cost of these P.W.A. projects may be assumed roughly at $100,000,000 for arriving at an approximate grand total. Of these 287, 85 had been completed, 97 were under construction, 63 were suspended pending litigation in the courts. Of the latter, 51 cases involve issues similar to the Duke Power case, now under consideration by the U. S. Supreme Court, and comprise allotments of $50,089,891, partly in the form of outright grants. As a register of such places, where the P.W.A. project was competitive to service already being rendered by a private company, a list is given herewith.

The summary of P.W.A. allotments is condensed from a list of such allotments for electric power projects running back to 1933 and revised to December 1, 1936. The news section of this issue contains a résumé of a report by Secretary Ickes listing those projects for which allotments were made during the calendar year 1936.

Finally, there are the 200 allotments made by R.E.A. in the sum, as of December 7, of $43,033,079 for 38,513 miles of rural line to serve 136,659 customers, and a few minor items. These allotments are made from two funds—those available through the Emergency Relief Appropriation Act of April 8, 1935, and the R.F.C. funds through the Rural Electrification Act of May 20, 1936.

P.W.A. Power Projects in Litigation

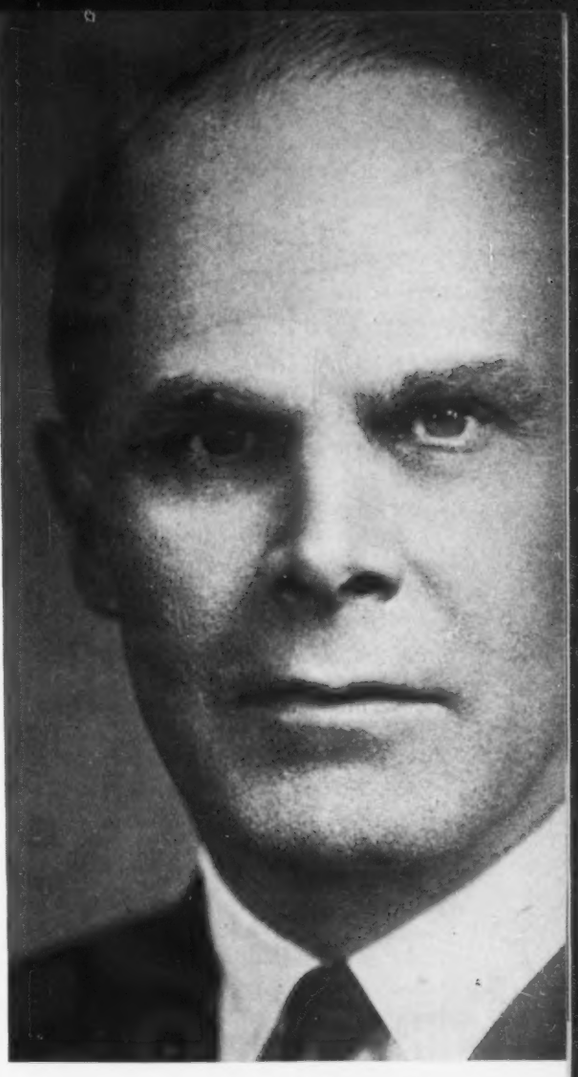
Cases Involving Issues Similar to Those in (Duke Case) Docket No. 3972, Greenwood County, South Carolina
Classified as to generation (G) and distribution (D)

Applicant	Type	Loan	Grant	Total Allotment
Alabama				
Decatur	D	$269,000	$81,000	$350,000
Sheffield	D	177,500	52,500	230,000
Tuscumbia	D	100,000	30,000	130,000
Bessemer	D	681,000	557,182	1,238,182
Tarrant City	D	181,000	148,091	329,091
Guntersville	D	48,000	39,272	87,272
Hartselle	D	33,000	27,000	60,000
Russellville	D	69,000	56,454	125,454
Arkansas				
Paragould	G	100,000	90,000	190,000
California				
Lodi	G	451,500	148,500	600,000
Colorado				
Delta	GD	155,000	42,000	197,000
Florida				
DeLand	GD	351,000	117,000	468,000
Illinois				
Centralia	GD	347,000	130,000	477,000
Jacksonville	D	231,000	189,000	420,000
Idaho				
Coeur d'Alene	GD	475,000	175,000	650,000
Iowa				
Lamoni	GD	73,000	24,000	97,000
Iowa City	GD	.....	413,000	413,000
Kansas				
Hoisington	GD	82,500	67,500	150,000
Michigan				
Menominee	GD	588,500	214,500	803,000
Minnesota				
Eveleth	GD	580,000	265,000	845,000
Glenwood	GD	.....	67,909	67,909
Janesville	GD	.....	31,455	31,455
Mississippi				
Aberdeen	D	66,000	54,000	120,000
Starkville	D	83,000	67,909	150,909
Missouri				
La Plata	GD	71,200	28,800	100,000
Trenton	GD	.....	88,000	88,000
Thayer	GD	39,000	32,735	71,735
Nevada				
Winnemucca	G	.....	$35,000	$35,000
Winnemucca	GD	.....	54,360	54,360
Nebraska				
The Central Nebr. Pub. Power & Irr. Dist.[1]	G	$5,500,000	4,500,000	10,000,000
New York				
New Hyde Park	GD	165,000	135,000	300,000
Plattsburg	GD	286,000	234,000	520,000
Ohio				
Sandusky	GD	1,085,000	430,000	1,515,000
Columbus	G	.....	320,000	320,000
Pennsylvania				
Myerstown	GD	.....	68,715	68,715
South Carolina				
S. C. Pub. Ser. Auth. (Santee Cooper)[1]	GT	5,775,000	225,000	6,000,000
Tennessee				
Knoxville	D	1,950,000	650,000	2,600,000
Lenoir City	D	29,000	23,727	52,727
Lewisburg	D	55,000	45,000	100,000
Paris	D	.....	135,000	135,000
Columbia	D	112,000	92,000	204,000
Jackson	D	364,000	299,500	663,500
Memphis	D	.....	3,092,000	3,092,000
Texas				
Liberty	GD	68,200	27,000	95,200
Plainview	GD	315,346	108,000	423,346
Huntsville	GD	83,000	67,909	150,909
Yorktown	GD	.....	45,000	45,000
Lower Col. River Auth., Texas[1]	GT	10,500,000	4,500,000	15,000,000
Leonard	GD	.....	32,727	32,727
Plano	GD	.....	45,000	45,000
Virginia				
South Norfolk	GD	.....	148,000	148,000

[1] These are multiple-purpose projects. A portion of the allotment is for irrigation and/or flood control.

The State of the Industry

By C. W. KELLOGG
President Edison Electric Institute



C. W. Kellogg

TO EACH of the quarter million men and women who operate the electric companies of the nation I extend hearty greetings and best wishes for the New Year.

It is good for both our poise and our enthusiasm to pause at the year-end to consider where we have come and what the future outlook is. May I suggest a few matters on which to reflect at this time.

The long depression is over and the definite upturn which began in the autumn of last year has continued unabated through the year just past. The production of electricity in 1936 (generated and purchased) of about 109,000,000,000 kw.-hr. is the largest in the history of the industry—14 per cent above the previous year and 18 per cent above the pre-depression peak year of 1929. The year just closed was a very dry one, so that the entire gain in energy output for the year was from steam plants. The duration and vigor of this upturn seems to justify the hope that it is not a mere flash in the pan, but a definite change from the former downward cycle of the depression period to an upward cycle, progress of which, for the present at least, should be sustained by the renewal of wornout industrial equipment accumulated during the depression and backed by the large supplies of credit now available at the lowest rates in our history.

Low rates and high taxes

The excellent showing of the electric industry as to output compared to 1929 is not reflected in the operating net earnings because these have been squeezed between the pincers of lower rates from the top and higher taxes from the bottom. Average residence rates per kilowatt-hour in 1936 were 25 per cent lower than in 1929, while taxes were, in per cent of gross earnings, 38 per cent greater.

Another factor not apparently reflecting the growth in energy output in 1936 was that the expenditures for generating plant extensions were not of outstanding proportions. The reason for this anomaly was that in 1930, the first depression year, the electric utilities continued to expand plant facilities at a rapid rate, believing at that time that the depression would not be severe nor long continued. Plant extensions in 1930 represented expenditures of $919,000,000, the largest of any year in the history of the industry; they were not needed in that nor following years, but they largely carried the electric companies up the grade during this past year. In 1937, therefore, installation of new generating equipment may be expected to go forward again vigorously. The plants of the manufacturers of major power plant equipment are reported to be already booked up through 1937.

Probably the most interesting engineering development of the past year has been the superimposed turbine. This consists of a high-pressure boiler (about 1,200 lb.) operating a turbine at about that pressure, the latter exhausting direct into the steam mains of the existing station. By the great increase in useful heat range thus obtained,not only are existing stations brought up to over-all thermal efficiencies, comparable with the best modern practice, but enormous investment in power station capacity, which might otherwise become obsolete, is thus completely reclaimed and rehabilitated. This is a reversal of the experience with past advances of importance, most of which have left substantial obsolescence in their train. It tends also to offset that part of the "power shortage," predicted a few years since, which was predicated on alleged obsolescence and, as 25 per cent of the electric plant investment is in steam plants, it may have a bearing on future depreciation requirements.

The expectation of continued growth in the use of electric energy in our country brings up the corresponding financial problems, for no formula has yet been devised to beat the insatiable demand of the electric industry for new capital at the rate of five or six to one for each dollar of new gross earnings. During the depression new capital requirements, due to relative stagnation of business, were of a magnitude such that they could be raised through current reserve funds without the necessity of selling securities. Even in 1936, when more than a billion and a half dollars of electric utility securities were sold to the public, only about 5 per cent of the total was for new capital, the rest being mostly to refund bonds at a lower coupon rate. In this connection it should be noted that the net saving from this refinancing is smaller than appears from the change in coupon rate, due to the combined burdens of

call premium on the former bonds, selling commission on the new bonds, costs of registration and the income tax on the greater net, so that on the average probably not more than half of the apparent saving is actually made from refinancing at the present time.

It is so many years now since major financing by the sale of securities had to be done by the electric utilities that it is easy to forget some of the essential requirements of the job. It is particularly easy to forget when, as now, bonds are selling at the lowest yield of all time. However, even bonds would soon become unsalable if they were not secured by an adequate margin of investment, sometimes called the equity. This margin, like the catalyst in certain chemical reactions, is the essential element without which things don't go. Except for the large city companies, this equity has in the past been obtainable in adequate amounts only through the holding companies. A group of the larger holding companies in the six years ended in 1930 raised one billion of the three billion of capital funds needed for the growth of the electric service in their territories and raised it by the sale of their own securities—an essential public service which would have been impossible without the combined credit they represented.

Holding companies

The credit of the holding companies, and consequently their ability to do this essential equity financing job, has been seriously jeopardized by the Public Utility Holding Company Act of 1935, which was passed by Congress a year ago last summer. The act was supposedly passed primarily to eliminate evils and abuses alleged to have developed in some holding companies by having their activities regulated by the Securities and Exchange Commission. In addition to drastic regulation, however, provision was made for the partial or complete dissolution of some holding companies on the basis of criteria unrelated factually to the public interest. Regulation by destruction is like governing a turbine by closing the throttle. True, the machine is thus regulated in the sense that it won't run away, but, on the other hand, it will produce nothing useful for mankind. The holding companies, adequately regulated, should be allowed to continue to exist in order to perform the twin services of equity financing and economical operation which are absolutely essential for the best public service at the minimum cost.

For the vast majority of you quarter of a million whom I am addressing these financial matters, although essential to the integrity of the service and to your welfare, are not your primary personal consideration. Yours is the task of keeping the electric service of the nation always up to the highest standard of perfection and of bringing the blessings of that "tireless servant" to a constantly widening circle, and in constantly increasing abundance. The vicious circle of long past years (when electricity was high because so little was used and so little used because it was high) has been definitely broken by the inducement rates with which you are familiar.

More customers

During the seven years of depression ending with 1936 the number of electric consumers has grown from 23,650,000 to 26,000,000, the average annual household consumption from 500 to 725 kw.-hr. and the average residence rate decreased from 6.33 cents to 4.74 cents. Sales of household equipment have grown similarly; electric refrigerator sales were about 2,000,000 in 1936, compared to 840,000 in 1929, and electric range sales 350,000 last year, compared to 180,000 in 1929.

In the effort continually to extend the electrical frontiers of the country the electric industry has been actively engaged for fifteen years in the drive to get electricity to the farm, not only by extending lines into rural districts but also by devising ways in which electricity could make farm life easier and more profitable. The electrification of farms has from the start presented two economic difficulties—one, the high distribution cost per farm when farms are far apart; two, the relatively low cash purchasing power of farms as a whole. In 1936 the average company investment for rural distribution systems was $266 per farmer and the average individual farmer's investment for wiring and equipment $210. It is encouraging to record that 1936 showed the greatest number of new farm customers added in any one year since before the depression, the total at the year-end being about 900,000. In recent years many state commissions, in order to encourage the extension of electric service to rural customers, have authorized such extensions on a ratio of expected earnings to investment, which in effect subsidizes the farmer at the expense of the city user of electricity. Recent activities of the federal government through the Rural Electrification Administration have tended still further to reduce this ratio and have thus stimulated electric extension into the rural areas.

The effect of the pincers of lower rates and higher costs which I referred to above may be expected to continue to press upon the net earnings of the electric utilities during the coming year. The three main items of cost—fuel, payroll and taxes—are definitely trending upward and the only way they can be prevented from making such pressure on net earnings that rate reductions will have to cease is to continue everlastingly with the selling job and to get the consumer to use the appliances when sold. The electric utilities are thoroughly alive to this condition and will probably spend about $70,000,000 in 1937 for sales promotion.

Public contacts

In closing, let me remind each of you of your personal responsibility for the success of the electric industry. While in the aggregate the electric business represents one of the greatest masses of invested capital in the country, yet it is in every-day life broken up into many millions of relatively small relationships — between the 26,000,000 consumers and the thousands of electric companies. Never forget that for each of these 26,000,000 customers one or more of you are in effect the company. The "integration" in which we should all be interested is the application of that word in its strict mathematical sense of "summation," to the millions of daily contacts between you and your customers. If every one of these is fair tactful, good natured, their integral (sum total) will be a satisfied public. Paraphrasing an old adage, look out for the individual contacts and public relations will take care of itself.

The engineers have measurably mastered the laws of inanimate nature in the design and construction of our generating and distribution systems: let us strive to master the much more intricate laws of human nature, so that all of our public will be satisfied not only with our electricity but with us.

Manufacturers' Sales Approaching 1929 Peak

By F. R. FISHBACK
President National Electrical Manufacturers Association

THERE seems to be good reason to believe that the electrical manufacturing industry as a whole may approximate its former 1929 sales peak in 1937 and during the coming year employment in the industry will greatly increase. Some major branches of the industry, such as appliances, and especially electric refrigeration, have already exceeded all previous records—indeed, electric refrigeration has done so both in 1935 and 1936.

The accompanying tables of index numbers prepared by H. L. Horton, manager of the statistical department of N.E.M.A., indicate very clearly the movement of the industry and its branches during the past twelve years. They point to encouraging advances in the near future.

Table I shows electrical manufacturing industry production and some related factors.

E.M.I. Production—As in other industries, peak production came in 1929 with a 56 per cent rise above 1925. Not shown in the table is the lowest point—reached in 1932, but 1933 was 49 per cent below 1925. Since 1933 continuous recovery has occurred, culminating in a 34 per cent increase in 1936 over 1935 and forcing the production level 13 per cent above 1925.

E.M.I. Employment—It is impossible to make any exact comparison between production for the electrical manufacturing industry and employment. To make an exact comparison, production should be expressed in terms of quantity units. Because of the thousands of different electrical products represented and the great technical changes made in them over a period of years no quantitative measurements can be applied to the industry as a whole.

But broadly speaking, employment has generally followed the same pattern as production; rising in 1929, but not as high relatively, and sinking to a low in 1933, not as great relatively as did production. Since 1933 it has increased until now it is 11 per cent above 1925.

Manufacturing Industry Production—The Federal Reserve Board curve for all manufactures production shows less striking movement. A high of 13 per cent above 1925 came in 1929. In 1933 the index retreated to a point 29 per cent below 1925. Since 1933 a steady rise brought the index almost back to the 1925 level.

Electric Power Sales—An enviable record has been hung up by the utilities in the sale of electric power, as most readers of ELECTRICAL WORLD are well aware. Measured in terms of 1925, it showed a 50 per cent increase during the four-year period 1925-1929; suffered somewhat of a setback from 1931-1933, then surged forward to an all-time high, approximately 80 per cent above 1925.

Population—Finally, as a reminder that the world doesn't stand still even during depressions, are shown figures for population growth. A steady increase has occurred, slackening somewhat during the past few years, to a point in 1936 12 per cent more than 1925. In considering the other factors, this growth in population tends to discount to some extent the improvement already shown. But it also points to the possibility of still greater advance.

Turning now to some of the principal branches of the electrical manufacturing industry—Table II shows nine of them—we find that recovery has not come to all in equal degree.

Appliances—Perhaps this branch of the electrical manufacturing industry has, outside of refrigeration, made the most rapid recovery. In 1929 sales were 12 per cent above 1925; in 1933 they had retreated to a point 41 per cent below 1925. During the next three years they showed an almost breath-taking rise to a point 27 per cent above 1925.

Household Refrigeration—During recent years the public has received the electric refrigerator with acclamation. In the short space of four years (1925-1929) it became one of the largest branches of the electrical manufacturing industry. From an index of 100 in 1925, representing

F. R. Fishback

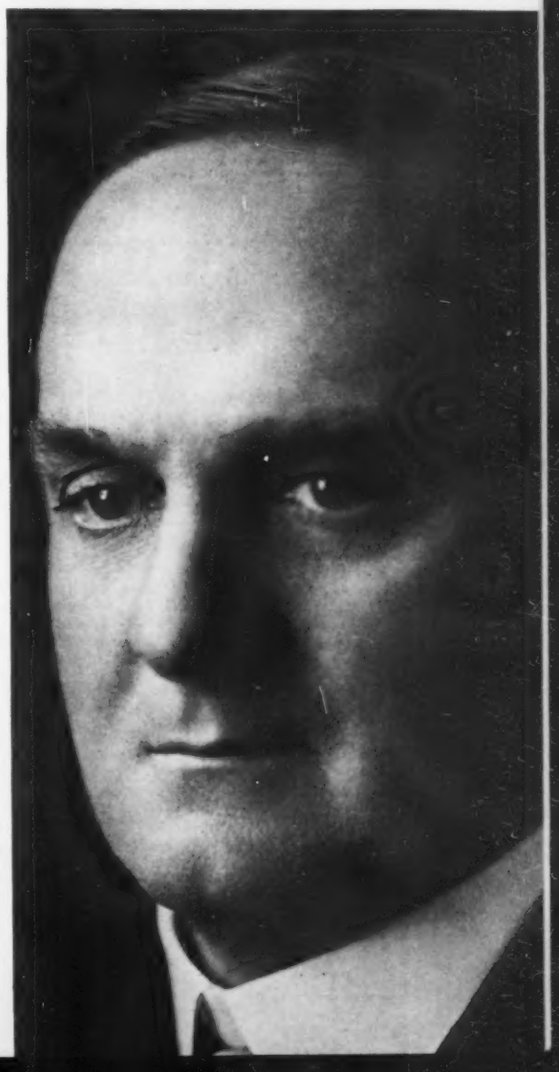


Table I—The Electrical Manufacturing Industry and Related Factors, 1925-1936

Index Numbers 1925 = 100

	1925	1927	1929	1931	1933	1934	1935	1936
1. E. M. I. production	100	112	156	85	51	70	84	113
2. E. M. I. employment	100	101	137	90	68	90	97	111
3. Manufacturing industry production	100	101	113	76	71	74	86	99
4. Electric power sales	100	122	150	144	131	141	155	180
5. Population	100	103	106	108	109	110	111	112

NOTES

1. *E.M.I. PRODUCTION* based on U. S. Census of Manufactures and data compiled by N.E.M.A. statistical department. In addition to products shown in Electrical Machinery Apparatus and Supplies schedule of the Census are included Electrical Refrigeration, Radio Apparatus and Supplies, Steam Turbines—other than Marine, Electrical Porcelain, Glass Insulators and Electrical Washing Machines.
2. *E.M.I. EMPLOYMENT* based on labor series of National Industrial Conference Board but adjusted to 1925 = 100. This series represents the Electrical Manufacturing Industry, including Radio.
3. *MANUFACTURING INDUSTRY PRODUCTION* based on the Federal Reserve Board Index for the Manufacturing Industry and adjusted to 1925 = 100.
4. *ELECTRIC POWER SALES* index figures for 1927-1935 based upon Edison Electric Institute data. 1925 and 1936 have been estimated by the N.E.M.A. statistical department.
5. *POPULATION* based upon the annual mid-year estimates of the U. S. Bureau of the Census.

All data for 1936 are estimated.

$16,000,000, it soared to 766 in 1929, and while other branches faltered, it mounted still further to 778 in 1931. Then came a short recession in 1932 and 1933 followed another forward surge, culminating in an all-time peak of 1,138 in 1936.

Construction Material—This branch of the electrical manufacturing industry showed a rapid rise in sales of 35 per cent from 1925 to 1929. The depression had brought a 56 per cent drop by 1933. Then came an almost constant rate of increase to a point in 1936 13 per cent above 1925.

Industrial Apparatus—From 1925 to 1929 sales increased at a rate faster than any of the other eight branches shown—excepting refrigeration. The beginning of the depression brought this rapid growth to a full stop. By 1933 sales had dropped 69 per cent from 1929. A strong recovery has been registered, however, since that time. At the end of 1936 sales were 13 per cent above 1925.

Roughing-In Material—Contrary to the movement of the other branches, roughing-in material sales dropped 11 per cent from 1925 to 1927. This lost ground was fully recovered, however, in 1929 and a 27 per cent advance was shown. After a 66 per cent decrease to a low point in 1933, sales increased steadily at about 25 per cent per year. By the end of 1936 the industry still was 10 per cent below 1925.

Installation Devices—Sales of installation devices rose 40 per cent during 1925-1929, then dropped 61 per cent from 1929 to 1933. No increase was shown in 1934, but during 1935 and 1936 a steady rise took place, bringing sales to a point 14 per cent below 1925 level.

Generation Apparatus, Transmission and Distribution Equipment, Insulated Wire and Cable for Light and Power—Of particular interest are the movements of apparatus and equipment used by public utilities. After a drop to a point in 1933 more than 80 per cent below 1925, all three branches have shown slow increases to levels still well below 1925.

A rapid rise of unfilled orders indicates substantial increases in the heavy equipment branches of the electrical manufacturing industry during 1937.

One of the consequences of this development, especially in the indus-

Table II—Principal Branches of the Electrical Manufacturing Industry, 1925-1936

Index Numbers 1925 = 100

	Manufacturers' Sales	1925	1927	1929	1931	1933	1934	1935	1936
1. Appliances	100 = $140,000,000	100	105	112	75	59	80	99	127
2. Refrigeration	100 = 16,000,000	100	425	766	778	574	747	856	1,138
3. Construction material	100 = 38,000,000	100	100	135	71	59	74	91	113
4. Industrial apparatus	100 = 132,000,000	100	105	149	75	47	61	80	113
5. Roughing-in material	100 = 14,000,000	100	89	127	73	43	54	67	90
6. Installation devices	100 = 20,000,000	100	120	140	81	54	54	70	86
7. Generation apparatus	100 = 37,000,000	100	100	130	57	26	32	44	60
8. Transmission and distribution equipment	100 = 180,000,000	100	104	119	63	22	31	42	74
9. Ins. wire and cable for light and power	100 = 110,000,000	100	106	133	54	27	36	46	65

NOTES

1. *APPLIANCES* include domestic, kitchen and table appliances, ranges, water heaters, vacuum cleaners, washing machines, fans and food service equipment.
2. *HOUSEHOLD REFRIGERATION* includes complete units, parts and cabinets. Commercial refrigeration equipment and air-conditioning equipment are excluded. These index figures appear unusually large because the household refrigeration industry was just beginning about 1925 and therefore the base figure is small.
3. *CONSTRUCTION MATERIAL* includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.
4. *INDUSTRIAL APPARATUS* includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding large power generators). Electric furnaces and electric tools are excluded.
5. *ROUGHING-IN MATERIAL* includes conduit fittings, outlet and switch boxes, non-metallic flexible conduit, underfloor duct and floor boxes, flexible metallic conduit and rigid conduit are excluded.
6. *INSTALLATION DEVICES* includes signaling apparatus and wiring devices.
7. *GENERATION APPARATUS* includes large generating and converting apparatus and steam turbines (excluding steam turbines for marine installation).
8. *TRANSMISSION AND DISTRIBUTION EQUIPMENT* includes switchgear, capacitors, feeder voltage regulators, high-voltage insulators, power and distribution transformers, lightning arresters, pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers, and electrical measuring instruments.
9. *INSULATED WIRE AND CABLE FOR LIGHT AND POWER* includes wire and cable of various types of insulation used primarily for lighting and power circuits and lines. Bare wire is excluded.

All indexes based upon U. S. Census of Manufactures data and N.E.M.A. statistical department data corrected where possible to represent the entire industry. All data for 1936 are estimated.

trial apparatus, generating apparatus and transmission and distribution equipment branches of the industry will be an almost inevitable delay in deliveries before the end of the year. Indeed, in some branches the condition is already here. A dearth of skilled labor in many localities—in fact, a dearth of particular kinds of skilled labor in nearly all factories—has already been keenly felt. Customers probably will pay the penalty of having delayed their orders, for bottleneck jobs are often the key to the situation on deliveries, and skilled men can not be trained or retrained for such jobs overnight. The industry will, however, do its utmost to serve its customers as promptly and efficiently as situations permit for the condition may continue well into 1938 and possibly 1939.

Higher prices

Rising costs and prices can also be expected. Wage rate increases, raw material costs and heavier taxes—federal, state and local—are pointing to higher prices.

Moreover, demand usually grows more rapidly than capacity in times of recovery. Factory building has always lagged as we came out of a depression, and it continues to lag well into the prosperity period, owing to early commitments and contracts. This pent-up demand is likely to be a considerable factor in precipitating further price elevations. In fact, a seller's market is already here in some lines.

This demand for electrical products seems destined to continue. Electricity, directly and indirectly, has been publicized in the last few years as never before. The public has been made conscious of what it "ought" to want by the efforts of the utilities, the manufacturers, wholesalers, contractors and dealers. Rightly or wrongly, energy rates are lower. And the public is demanding more electrical conveniences, as is amply demonstrated by data published elsewhere in this issue. It shows up clearly in N.E.M.A.'s index numbers on appliances, electric refrigeration, industrial apparatus and construction material sales. Factory modernization has gone electrical in many respects—in machine tools and other machinery; in industrial lighting for better sight and greater production; in spread of electric welding and heating processes, to name but a few. This is just the beginning of the surge in the market for industrial electric equipment.

Replacement and modernization are the order of the day in the factory equipment field, and the age of excess capacity is rarely mentioned as this year-end approaches. New factories are already being built, new and additional capacity will soon be added. If some of the storm signals now flying are hauled down, American industry within four years may be producing far more goods than it has ever produced before.

It is hard to believe that as a nation we will stand for the concept of limitation of output. Hazy or wrong-thinking individuals or groups may, but not the nation as a whole. It will be interesting and profitable to contrast the prevailing economic ideas of three years ago with those of three years from now. Indeed, a transformation has taken place already.

With this upturn in business, the energy of the members of N.E.M.A. has been galvanized into constructive sales effort; individually and co-operatively. It shows up clearly in the trade and business press columns, as well as in newspaper and general magazine advertising. N.E.M.A.'s business development plans fell on fertile ground and at the right time—both in the various markets to which the industry sells and in the association as a whole. The Kitchen Modernizing, Electrical Housewares, Better Light-Better Sight, Rural Electrification, and Adequate Wiring efforts, in co-operation with other organized branches of the industry, are firmly rooted. And they aren't just a substitute for former activities such as coping with NRA problems. This comprehensive plan was begun and adopted before the famous Schechter decision. The electrical manufacturing industry is out after a larger share of the consumer's dollar and of the dollar spent on industrial equipment.

Continued Improvement in the Year 1937

By GERARD SWOPE
President General Electric Company

At this time last year we stated we expected a continued improvement in business for 1936, but the outlook was not particularly good for capital goods in the public utility and transportation fields. This has been borne out.

The public utilities have followed in 1936, as in previous years, the policy of giving the consumer the benefit of lower rates. As a result the use of electricity has continued to increase so that in 1936 we had the largest consumption of electric energy ever reached in this country. The people of the United States now use more than four times as much electric power per capita as the rest of the world.

For 1937 we look forward to a continuance of improvement in business. As the increased use of electric energy continues, of course there will be a decrease in the margin of surplus generating capacity, which is so essential to the rendering of good service to the public. Hence it will be necessary for the utilities to increase their plants, with a consequent expansion in orders for heavy goods, which are so much needed in our shops and to restore general employment in capital goods industries.

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Prospects for Electrical Manufacturers Bright

By A. W. ROBERTSON
Chairman of Board
Westinghouse Electric & Manufacturing Co.

The prospects for the electrical manufacturing industry are very bright. Practically all divisions are operating at capacity and orders in sufficient volume are coming to warrant an optimistic view for the next several months. Incoming business is not confined to any one type of product. The demand for household goods is excellent and the public utilities and industry generally are making substantial purchases.

Notwithstanding many threatening, unpredictable contingencies, there is evidence that we are moving upward along a more or less typical American business curve. The upward swing may continue for a considerable time.

It is now the problem of industry, government and individuals to make certain that the present improvements will be maintained, to the end that business conditions in the future will not be subject to the violent, disastrous fluctuations experienced in the past.

Growth in Output Keynote of E. E. I. Engineering Groups

By A. H. KEHOE
Vice-President Edison Electric Institute

VIRTUAL cessation of plant expansion during the recent depression provided an unusual opportunity, although an unwelcomed one, to check up on the efficiency and reliability of the various operations in our business. The engineering committees of the Edison Electric Institute have done just this during the past few years. Operating performance, maintenance costs, investment costs and the possibility of alternative designs have all been carefully scrutinized. Now that the industry is at the threshold of another era of expansion, it is proving to be very beneficial to review the findings of this testing period; to look over the record, and to utilize the information available in meeting the problems immediately ahead.

In the field of power production, an outstanding result of the recent critical analysis is the impetus which is being given to the process of reconditioning the older and less efficient steam plants by superposition of high-pressure, high-temperature steam units and accompanying this with modernization of their obsolete boiler installations. This gives increased capacity at very low cost and greatly increases the over-all efficiency of production.

Such a process of salvaging the principal part of the original capital investments in old plants is not a recently conceived solution. The possible advantages of higher steam temperature and pressure on the economy of production had been visualized for many years as a bogey of possible attainment, but physical limitations of available materials and processes prevented the immediate realization of this objective. The search for better materials, new fabrication processes, and discovery of the operating technique necessary to make such processes a reality, constitutes a characteristic episode in the physical development of electric supply systems. The practical realization of suitable materials for boilers, piping and turbines to operate at high temperature and high pressure and the development of operating equipment from these are the result of persistent engineering and research over a long period. Chemists, metallurgists, design and operating engineers all have contributed to the development. It is most opportune that a satisfactory method of prolonging the useful life of existing low-pressure steam plants should become available for wide use at a time when, due to growth in the industry, some disposition of low efficiency plants becomes imperative.

Steam station technique evolving

Developments of this kind are not static. Numerous problems of adjustments and redesign incident to the introduction of these basic changes in plant design require careful attention. As an instance of this, arrangements to eliminate the possibility of oil fires which were experienced in a few instances following the introduction of higher steam temperatures seem to have been reached as a result of committee deliberations. A few of the many problems uppermost in the minds of our engineers who are active in this field are: Better circulation in boilers as a means of acquiring higher evaporation rates; further simplification of layouts and boiler control systems; segregated unit design for multiple unit stations or for single unit stations for application in assigned load areas, and increasing use of oil and gas for boiler fuel and for engine operation. The prime movers committee, with P. W. Thompson of Detroit as chairman, gives continuous attention to problems of the above character and to a great variety of minor problems associated with power plant operation.

Expansion of our hydro-electric plants has been practically at a standstill for several years. However, a nucleus of those who served on the hydraulic power committee when work was active have been organized this year under the chairmanship of Carroll F. Merriam of Baltimore. Attention is being given by this group to new developments by manufacturers, maintenance problems and to new field applications arising from changes in the art.

Expansion of transmission and distribution facilities has become the order of the day. This phase of our E.E.I. committee activities is directed by P. H. Chase of Philadelphia as chairman of the transmission and distribution committee. In this field satisfactory operating experience is reported with wood poles as a means of increasing the surge impedance of transmission lines. The favorable cost procured with such lines forecasts increasing use of this type of construction at some line voltages for which steel construction exclusively has heretofore been used.

Rural lines present new problems

The attention which for many years has been devoted to a standard of pole line construction sufficiently low in cost to justify extensions into sparsely loaded territory adjacent to our lines has resulted in practices which are now being applied in the rural sections of the country. A great deal of attention is being given to rural line construction, with special reference to possible economy and reliability resulting from simplicity of design and standardization of materials and installation methods. The greater vulnerability of such lines and the somewhat different operating problems arising from possible high impedance faults in these far-flung extremities of distribution systems introduce protection and maintenance problems in many cases which require

a different kind of treatment from those in common use. These matters are being scrutinized in order to work out solutions most appropriate for the conditions encountered in individual cases.

The relatively high proportion of total system cost for transmission and distribution facilities is a matter which is always before our engineering committees. In this connection it is expected that further standardization of materials and methods will improve costs by allowing for large quantity production of equipment line material incident to the use of fewer items and also fewer sizes in each line.

While attention is being given to means of lowering unit costs of line construction, it is also realized that in high load density areas, where a large number of parallel feeders is required, the use of higher standards of construction even with higher unit costs will probably result in lower over-all costs because of the influence of a higher degree of perfection on outage contingency and number of feeders required. The noteworthy performance of several types of oil-filled cable over a period of years suggests the possible attainment of better records of performance on distribution circuits both through the use of better design and materials and through higher standards of construction. This approach to the problem of minimum possible investment has also been exemplified in high-voltage line construction, wherein better knowledge of operating conditions made available by automatic recorders of different kinds, improvements in circuit breakers and construction standards, and more reliable lightning protection, account for the much improved standard of performance of modern high-tension transmission lines. There seems to be no reason to doubt that continued effort toward greater reliability of operation will result in the further improvements both in higher standards of service and in lower over-all costs.

Voltage regulation activity

Consideration is now being given to refinements in design and construction of low-voltage a.c. network systems and high-tension primary networks. The use of series capacitors and automatic tap-changing transformers as a means of improving the voltage regulation of radial feeders and the application of automatic reclosing circuit breakers as a means of reducing customer outages have been found helpful in rendering a higher standard of service. Experience under extreme storm and flood conditions both in rural and urban areas during the past year have been digested by the engineering committees concerned and the industry should be able to sustain future occurrences with improved service records and with greatly reduced losses.

Work has also been very active in the field covered by the electrical equipment committee. This group, under the chairmanship of J. F. Fairman of New York, considers matters pertaining to station design, services, utilization equipment as well as the design and performance of electrical equipment in general. In the electrical design of stations, simpler switching arrangement, 3,600-r.p.m. generators and hydrogen cooling of generators, condensers and frequency changers are being adopted in many new developments which are now in progress.

New methods for metering and service

Outdoor installation of meters has grown in popularity following the code revision on meter sequence, which permits the meter to be mounted ahead of the service switch and fuses. This development has been accompanied by the development of improved facilities for mounting and testing meters, more compact installations and small size of polyphase meters. Also, lower cost service connections for overhead services have been made possible by new types of service-entrance cable. One recent type in particular which is covered with non-metallic braid is being installed direct from the street to the service point, which in many new installations is located adjacent to the kitchen range.

Further development and additional possible uses of electronic tubes are being observed and substantial improvements have been reported in the operation of the latest type mercury-arc rectifiers. Old type circuit breakers equipped with modern arc-quenching devices and with improved design terminal chambers and bushings have been installed, along with other changes, as part of a general program of modernization of old equipment. Co-ordinated system planning, reserve capacity practices of different companies and automatic bus protection schemes are some of the important problems now before Mr. Fairman's committee.

A. H. Kehoe

The engineering activities of the E.E.I. committees also include a group headed by W. A. Buchanan, devoting its attention to accident prevention and more recently to the health of employees as well. At present this committee is devoting special attention to a cause and locus study of accidents. The committee recently sponsored a report on grounding, in co-operation with the other committees involved, which is believed to be the most authentic information available on this important subject.

Any summary of such an extensive field must deal only in general terms with broad subjects and cannot indicate the many ways in which the action of our various committees serve the industry by lowering costs or improving standards of service. In a period of expansion of system capacity the co-ordination between engineers becomes even more important, and thus the outlook is for greater activities and accomplishments in the next few years.

Editorials

HOWARD EHRLICH . EDITOR

N.E.M.A. Has Broad-Gauge Program for 1937

THE N.E.M.A. program of projects, activities and services for 1937, which was released to the membership in December, is the most complete and thorough analysis which the association has yet adopted, and much more satisfactory than the statement of program adopted for 1936, or the relatively brief statement for 1935.

Instead of presenting the program as a lump sum budget, a new procedure was initiated whereby the 1937 program was presented, project by project, to the Policies Division at its annual convention in Cincinnati, together with the estimated costs for 1937 of each project. In this way the N.E.M.A. members were in a well-informed position to judge the merits of each activity and whether or not it was costing too much or too little compared with the benefits received.

N.E.M.A. is especially to be commended for the adoption of its broad-gauge business development program, which took form originally as a result of an effort to straighten out the difficulties regarding the business development activities of one of its sections.

It is important to remember that N.E.M.A.'s business development program was drafted during the winter of 1935, and was formally presented and adopted at the Hot Springs meeting in 1935, one week before the famous NRA Schechter decision. In other words, it is rooted in the needs and desires of the membership and is not merely a substitute for activities prevailing during the NRA days.

It is almost impossible to realize how the business development program has expanded since the spring of 1935 into a program embracing not only adequate wiring and rural electrification as general programs, but also the particular programs affecting a limited number of sections, such as Kitchen Modernizing, Electrical Housewares, Electric Water Heating, Electric Welding, Better Lighting, Better Sight, Street and Highway Safety Lighting, etc.

N.E.M.A. was originally organized to co-ordinate work of the electrical manufacturing industry in the field of codes and standards. It has gradually taken on expanding statistical research, activity in the field of national legislation, several new activities such as industrial relations, insurance, the advertising clinic, etc., but most important to the membership and to the industry as a whole is business development.

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Co-operation With R.E.A. on Rural Service Extension

A FEW WEEKS ago ELECTRICAL WORLD commended to the utility industry the Arkwright plan, a progressive arrangement whereby Preston S. Arkwright and his Georgia Power Company arranged with the Rural Electrification Administration for a completely co-operative program of rural service development.

This was just the beginning, for now Texas Power & Light's John W. Carpenter announces a co-operative plan whereby company engineers are made available for R.E.A.'s survey work and assist in the preparation of applications for R.E.A. allotments. Furthermore, with the rates settled satisfactorily between the company and the R.E.A., a contract is pending under which the company would furnish wholesale power to the rural "co-operatives."

Like Georgia Power, Texas Power & Light has gone into rural electrification on a large scale. During 1936 2,000 miles of new T. P. & L. rural line made electric service available to 10,000 farms and rural homes.

Before the year ends, may the names of Arkwright and Carpenter head a long list of utility presidents who found a way to work out mutually satisfactory, truly co-operative arrangements with R.E.A.

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Paving the Way for the Major Appliance

ONE OF the fundamental precepts of utility operation today is to make sure that so far as possible every kilowatt added to the lines promises a long-hour use. Applied to domestic and rural business, this precept has resulted in unusual attention being directed to the three major load builders, the refrigerator, the range and the water heater.

A new light on the relative importance of load-building devices, with respect to sales program schedules, is introduced by Philip H. Powers, vice-president of West Penn Power. Speaking at the Northeastern Regional Farm Power Sales Conference at Schenectady, Mr. Powers held up the electric water pump as an example of an appliance which of itself does not appear especially attractive as a load builder, but which deserves more attention from the utility company because it paves the way for those other appliances

which are recognized to be excellent load builders.

Simply to illustrate the point, Mr. Powers had a quick survey made of 1,000 customers, selected as far as possible to eliminate the effect of such factors as rented versus owned farms, purchasing power, etc. The selected list was divided into two equal parts, one of 500 farms with running water service, the other of 500 farms without it.

The 500 farms with running water service, according to Mr. Powers' survey, showed 96 per cent radio saturation, compared to 90 per cent on the other 500 farms. Washing machine saturation, 90 per cent compared to 80 on the other farms. There were 20 per cent more ironers, and 125 per cent more ranges on the farms with running water service. Farms without the water service used 713 kw.-hr., those with it used 1,170 kw.-hr.

As Mr. Powers says, the base for comparisons is quite narrow, but already the moral seems to be: Don't neglect the minor load builders, which pave the way for the major load builders.

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Carrots and Lighting

IF ONE eats carrots regularly, according to Dr. M. Luckiesh, one need not fear night driving blindness, the cause of so many road accidents. It seems that this trouble is caused by a deficiency of the well-known vitamin A.

This is but one of the directions that studies of the psychological and physiological relationships of seeing is taking. The more we know about fatigue, nervous reactions, pulse frequency, etc., under differing conditions of lighting the easier will be our problem of selling higher lighting intensities.

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Value of the Service

LIKE the "gob" on leave who goes out for a boat ride, the two utility men at a social gathering were deep in a discussion of utility matters past, present and future.

"Here's something I've been wondering about," one said to the other. "You remember how much trouble we had during the depression convincing the customer that the rates for electric service should not go down the way other commodities did. Of course, now that the price of everything else is going up, one headache on rates has disappeared," and the other nodded.

"But what are we going to do in the next panic," the first continued, "when the customer again tries to reduce his electric bill by cutting down on his use? Half of his kilowatt-hours are priced anywhere from half a cent up to two cents. What's he going to say when he cuts his usage in half but only reduces his bill by a tenth?"

"You've answered your own question," opined his listener. "The value of the service he receives will be so much greater than the cost of it that your customer will soon see the futility of chipping a few kilowatt-hours off the bill."

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Some New Statistics on Diesel Operation

DEPRECIATION in internal-combustion engines used as power station prime movers is a disputed question. Maintenance cost is surely a large factor in fixing rate of depreciation, and for that reason figures cited by Lee Schneitter in his recent A.S.M.E. paper are significant. Thus:

Abrasive ash in the fuel makes rapid cylinder-liner wear when over 0.05 per cent; with 0.03 per cent ash, liner life might be six to eight years, but only two years with 0.08 per cent. Loss of capacity from liner and engine wear was found to be of the order of 20 per cent during the interval between liner renewals. This means that a 3,750-kw. plant should have been bought to serve a sustained 3,000-kw. load. In addition, the average heat input over the period between liner replacements was about 11 per cent higher than that shown for new engines.

Another fact brought out in this analysis of records of several typical, utility-type, three-unit Diesel stations shows that concurrence of major overhauls causes peaks of maintenance expense after about the first seven years and at about six-year intervals thereafter. Maintenance costs for two of these stations were 1.7 and 1.04 mills per kilowatt-hour during their first seven and three years respectively. After liner replacements were made the average maintenance costs for these two stations were 2.85 and 1.70 mills per kilowatt-hour respectively. In both these cases unit maintenance costs jumped about 65 per cent subsequent to the rehabilitation that followed the first cycle of operation. Other stations showed maintenance costs of 2.8 and 1.9 mills per kilowatt-hour for periods of ten to eleven years' operation.

Several tables were presented showing outage data and causes for Diesel engine outages. This is the first time any data of this nature have been collected. These data show that outage time will average about ten per cent of demand or service hours.

The paper added quite a lot to the tangible aspects of operating and maintenance problems in connection with internal-combustion engines. Many debatable points of Diesel engine operation are covered in clear, simple terms.

News OF THE WEEK

Electric Industry Reports Gains in Year of Contradictory Trends

Uncertainties arising from holding company act seen problem by Kellogg — Power production reaches all-time high as utilities share in business revival — Customers show increase of 675,000 in year

Electric utilities must continue unceasingly at the selling job and in getting the consumer to keep using appliances, once they have been sold, as a means of preventing higher fuel, wages and taxes from exerting such pressure on net earnings that rate reductions will have to stop, in the opinion of Charles W. Kellogg, chairman of Engineers Public Service Company and president of the Edison Electric Institute.

In his annual review of the activities of the electric light and power industry Mr. Kellogg stated that contradictory trends featured the year 1936. From a short-term standpoint, he said, the rapid expansion of business has produced greater sales, larger revenues and a considerable increase in new income. "From a longer point of view, the power companies have been faced with the necessity of large-scale plans for the expansion of their plants, while at the same time they have been confronted with the uncertainties arising from the public utility holding company act."

Shares in business revival

It was pointed out by Mr. Kellogg that the electric light and power industry has shared fully in the revival of business activity, output during midsummer running some 18 per cent above the same 1935 period, although this was not maintained during the last quarter because of the sharp rise in industrial output during the corresponding period of the previous year.

"Production of electricity together with power purchased from other sources during 1936 may be estimated at 109,000,000,000 kw.-hr., an increase of 13.5 per cent over 1935 and 17 per cent over the pre-depression peak reached in 1929," Mr. Kellogg said. Because of the drought output of hydro-electric power showed little gain over the previous year, while production of electricity by fuels reached 69 billion kilowatt-hours, or 23 per cent over 1935, he said.

Mr. Kellogg pointed out that use of electricity for domestic service showed the usual annual growth and set a new high record in 1936, being 10 per cent above the previous year. The average annual use per consumer was 725 kw.-hr., as against 673 in 1935 and 500 in 1929. He said that this increase was largely the result of the sale during the year of more than 2,000,000 electric refrigerators and the large purchases of appliances of all kinds, notably washing machines, ranges and vacuum cleaners.

The number of homes using electricity was increased by some 675,000 in 1936 as a result of the further extension of lines and the return to separate homes of families which had "doubled up" during the depression, Mr. Kellogg said.

"In 1936 some 20,000 miles of new country distribution lines were built by the utility companies, serving 95,000 new rural customers," he said. "In addition to this, 60,000 rural customers were added to existing lines. Including 30,000 arising from a reclassification from residential to farm customers, about 110,000 new farms were added to the utility lines during the year, bringing the total of farms served at the end of the year in excess of 900,000."

During the year upward of 440,000 kw., including 85,000 kw. at Boulder Dam and 82,500 kw. at the T.V.A., were added to generating capacity. Of this some 200,000 kw. consisted of steam turbines.

Mr. Kellogg stated that the most important development of the past few years has been the superimposed turbine, which by the great increase in useful heat range thus obtained enable existing stations to be brought up to over-all thermal efficiencies comparable with the best modern practices.

The average price of electricity for domestic service at the end of 1936 was 4.74 cents a kilowatt-hour, as against 5.03 cents in 1935 and 6.33 cents in 1929.

Effect of rate cuts

Revenues from consumers showed a much smaller rate of gain during the year than electric sales because of further rate cuts, Mr. Kellogg said. Revenues totaled $2,071,000,000 or 8 per cent above 1935. Expenses increased 12 per cent, however. Net income available for dividends and surplus for the industry increased about $46,000,000, a gain of 11 per cent over 1935.

It was pointed out by Mr. Kellogg that financial operations during the year aggregated $1,250,000,000, all of which, with the exception of $75,000,000, represented refunding. More than $275,000,000 was spent for new construction during the year by the industry.

T.V.A. Predicts New Economic Era With Greater Use of Electricity

Problem in region in future will be one to produce power to meet the demand and not find a demand for power — Annual report shows net investment in electricity at $7,391,649 and in flood control and navigation $81,345,549 — Receives $1,170,505 revenue

The problem in the Tennessee Valley region in the future will not be one to find a demand for power, but to produce the power to meet the demand, the Tennessee Valley Authority predicted in its annual report submitted to President Roosevelt and the Congress. Mass production and mass production of electricity may open a new economic era, the report stated.

It was pointed out in the report that there is every indication that the market for power will continue to grow steadily. Substantiating its claims for a vast power market in the future, the T.V.A. cited the remarkable strides which private utilities have made in the past year in expanding their markets and increasing the customers' use of electricity. It was said that the increase of 19 per cent in power production by all agencies in the region between May, 1935, and May, 1936, is an indication of what may be expected in the future.

"This conclusion, expressed in the last report to Congress, is confirmed by the findings of the National Power Survey of the Federal Power Commission," the report stated. "The power demands in the Tennessee Valley will soon exceed the existing dependable supply. The wisdom of power developments planned for at T.V.A. dams now authorized and under construction, and of the provision made for further installations when needed, seems amply demonstrated."

The annual report stated that during the year studies carried on by the T.V.A. staff in co-operation with the Federal Power Commission have confirmed the following:

1. There is a wide variation in the character and needs of the various neighboring private utilities. For the next two or three years several of these utilities will be short of water and will need to purchase firm energy in the event that there is an extended dry period.
2. While none of the utilities studied is at the present moment in a precarious position with respect to meeting its market requirements, several will be pressed in the near future and will require additional capacity or energy or both.
3. In several other cases, where there is no physical shortage of either firm energy or capacity, surplus power could be conveniently and profitably purchased for the replacement of power generated at some plants which are partly obsolete and are operated at relatively high cost.

The report summed up by stating that "it has been clearly demonstrated that the development and sale of Tennessee River power, which is provided in the T.V.A. act, has cheapened retail prices for electricity in this area; that it has broadened the market to such an extent that privately owned utilities have been able to sell greatly increased quantities of power, and that it has brought social and economic benefits to the people of the region."

The report goes into detail concerning other activities of the T.V.A. in soil erosion, production of fertilizer, agriculture and other phases of the social program.

The report shows that the T.V.A. for the fiscal year ended June 30, 1936, received appropriations of $36,000,000 and the total received up to that date was $111,000,000. Net investment in electricity is listed at $4,263,611 for the year and $7,391,649 to date. The total to date in navigation and flood control listed as the net investment in Wilson, Norris, Wheeler, Pickwick Landing, Hiwasse, Guntersville and Chickamauga dams and reservoirs, other dam projects, general program and general maps and map records is $81,345,549 to date, including $40,104,701 made during the 1935-36 fiscal year.

T.V.A. reported total operating revenues of $1,170,505 for the fiscal year and net operating income of $584,783. Net income to reserve was $612,290 applicable for amortization, construction, interest and other purposes.

General Electric Company

CHRISTMAS DISPLAY LIGHTING—A multiplane scene decorating the roof of the lodge at the entrance of Nela Park. Lighted festooning, mounted behind the first two planes, lights the second and third planes in varying colors. Floodlighting is also used

Utility Asks Rehearing

Declaring that the Wisconsin Public Service Commission has no right to take electric facilities of a co-operative into consideration in deciding whether to authorize a public utility to extend its lines into an area, the Wisconsin Power & Light Company has applied to the commission for rehearing on the commission's order of December 3 denying the company authority to extend its farm electric lines north of Richland Center nine miles to Gillingham to serve 23 persons who signed contracts for service. The commission's denial was based principally upon the presence of co-operative poles in the area proposed to be served by the company.

Fire Cripples Electricity Supply, Throwing Newark Into Darkness

Damage to Essex generating plant of New Jersey utility estimated at $50,000—State Public Utility Commission to make investigation—Service restored by midnight after afternoon mishap

A fire that started in the circuit breakers and switches of the switching house of the Essex generating plant of the Public Service Gas & Electric Company of New Jersey at Point-no-Point, on the west bank of the Passaic River, threw the entire city of Newark, except three small districts, and parts of six neighboring communities into darkness last Monday.

The fire, which caused damage estimated at $50,000, started about 3.34 p.m. when a short circuit set fire to the oil in the circuit breaker, sooting up the main busbar so that it could not be used without danger until it had been cleaned. The five generators were kept running, but the plant, like the city, was without light or power until 6 p.m., when power was brought in from the Rahway station.

Office buildings as well as commercial and industrial establishments were without power and light when the current failed. Lamps, candles and other emergency lights were pressed into service.

Investigate origin of fire

In Newark, the northern part of the Forest Hill section, the Roseville section and parts of the Clinton Hill section were the only districts which had electric service.

Officials of the company are investigating the origin of the fire and the extent of the damage. For more than three hours the generator buses which convey the generated power from the plant to most of the fifteen substations in the area were inaccessible. Unable to use water, firemen pressed into service all available chemical apparatus to combat the fire. The heat became so intense, firemen said, that steel uprights supporting the switches literally became red hot.

By 8 p.m. service was partially restored and an hour later the downtown business section had electric power. Service was then speedily restored in other sections and it was reported that after midnight operations were on a normal basis.

Require auxiliary service

Harry Bacharach, president of the State Public Utility Commission, stated that engineers of the commission had been directed to make a thorough investigation of the failure of the service. He added that the commission "will insist and see to it that the utility takes immediate precautions to protect the lives and property of our citizens by requiring the furnishing of auxiliary service at all times, especially in such highly populous centers as Newark."

Emmet Drew, secretary of the New Jersey commission, said that the fire and its consequences were without parallel in New Jersey history.

A similar protracted outage occurred on the New York City system last January 15 when parts of the Bronx and Manhattan were without electric service. In view of the fundamentally different character of the two systems, it is believed that engineers will be eager to ascertain the causes of this second major interruption in the metropolitan district.

FLOATING SUBSTATION—Engineers of Arkansas Power & Light rigged this 1,500-kva., 110,000-volt "floating substation" to tap the company's line where it crosses the Mississippi at Greenville to supply energy to three 600-kva. Bucyrus-Erie electric tower machines in building levees.

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T.V.A. Workers Get Increase in Salary

Substantial pay raises for many employees of the T.V.A. went into effect January 1. Hourly wage employees will receive a new scale agreed upon by negotiation between representatives of T.V.A. and of the workers. Salaried workers will be graded into three classes, unsatisfactory, satisfactory or very satisfactory.

The first rating will result in dismissal, demotion or transfer to a different type of work. The second will bring a pay increase; the third a double pay increase. The size of the raises will be governed by the present salary scale. For those receiving up to $1,260, it will be $150; to $1,800, $180; to $3,500, $300; to $5,600, $400; above $5,600, $500. All T.V.A. employees are eligible for the increase except the three directors, whose $10,000 salaries are fixed by law.

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To Appeal to Higher Court

The Appellate Division of the Supreme Court in Brooklyn has granted the New York & Queens Electric Light & Power Company permission to appeal to the Court of Appeals, in Albany, from a recent decision of the Appellate Division. The decision in question denied the utility the right to call in preferred stock and issue new preferred which would be callable.

Florence Ullman Breslav, who claimed that she owned five share of the stock, objected to the "arbitrary" offer by the company to repurchase the stock at what she termed an "inadequate price."

P.W.A. Power Plant Allotments Include $13,941,901 of Grants

Secretary Ickes in annual report declares that first program is virtually completed, second at its peak, and third well launched—Allotments for non-federal power projects do not include ones now held up

Allotments for non-federal projects for electric power purposes in 1936 under Public Works Administration totaled $18,835,901, including $4,894,000 loans and $13,941,901 grants. The estimated cost of these projects is $31,509,765 and includes electric plants, power-water, electric distribution, light plants, power improvement and water-light.

In his annual report for 1936 Administrator Harold L. Ickes stated the P.W.A. enters 1937 with its first program virtually completed, the second at its peak and the third well launched, with the benefit of earlier experience, reaching construction faster than either of its preceding programs. The P.W.A. has allotted for 3,078 utility projects, which include waterworks, sewer systems, disposal plants, power plants, etc., in addition to allotments for other public works.

According to the tabulation of projects for electric power purposes loans totaling $1,940,000 and grants of $8,083,777 have been made. The estimated cost of these projects is $17,968,011. Power-water projects estimated to cost $12,805,609 include $2,954,000 loans and $5,528,199 grants from the P.W.A. The power projects reported by Secretary Ickes, in his annual report, do not include the ones held up by court injunctions, numbering fifty-one and involving allotments of $50,089,891 loans and grants.

Allotments for non-federal power projects are exceedingly small as compared with appropriations for other projects. Under the first P.W.A. programs there were 3,747 non-federal projects at an estimated cost of $1,115,609,736. Under the second program there were 3,953 projects at an estimated cost of $818,943,335. The third program was made possible, for the most part, from the $300,000,000 revolving funds and has involved P.W.A. grants of $120,180,358 and loans of $13,867,000.

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E. H. F. A. Closes Contract

Electric Home and Farm Authority has announced a contract has been closed with the Farmers' Rural Utilities, Inc., of Bowling Green, Va., providing for co-operation in financing the sale of electrical appliances.

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Edison Medal Award Given to Alex Dow

The American Institute of Electrical Engineers has awarded the Edison Medal for 1936 to Dr. Alex Dow, president of the Detroit Edison Company, "for outstanding leadership in the development of the central station industry and its service to the public." The Edison medal is awarded annually for "meritorious achievement in electrical science and engineering" to an individual chosen by twenty-four members of the institute. It will be presented to Dr. Dow during the winter convention of the institute in New York City from January 25 to 29.

Dr. Dow, born in Glasgow in 1862 and naturalized in 1895, has been a pioneer in the engineering, rate making and general operations of the electric light and power industry. He supervised the design and construction of several generating stations of the Detroit Edison system, and is called the father of the so-called "big" steam boiler in the United States, having installed 2,350-horsepower boilers at a time when 600 and 750-horsepower units were commonly considered large. He was the first to adopt the underfeed stoker for large installa-

Federal Emergency Administration of Public Works

Non-federal power projects allotted in 1936 under E.R.A. 1935 supplemental and D.A. 1936 programs as of December 9, 1936

Electric Plant

	Loan	Grant	Total	Estimated Cost
Bremen, Ind.		$8,100	$8,100	$18,050
Coffeyville, Kan.		90,000	90,000	200,000
Flandreau, S. Dak.		76,000	76,000	168,770
Herndon, Kans.		18,000	18,000	40,000
High Point, N. C.		2,595,000	2,595,000	5,766,750
Imperial Valley, Cal.	$1,518,000	1,242,000	2,760,000	2,760,000
Jackson, Tenn.	364,000	299,500	663,500	663,500
Knoxville, Tenn.		54,000	54,000	120,000
Lake Worth, Fla.		18,000	18,000	40,000
Memphins, Tenn.		3,092,000	3,092,000	6,872,000
Myerstown, Pa.		68,715	68,715	152,700
Nelsonville, Ohio		36,000	36,000	81,818
Newbern, Tenn.	33,000	26,000	59,000	59,000
Ohio City, Ohio	25,000	19,900	44,900	44,900
Pierre, S. Dak.		16,200	16,200	36,000
Shelby, N. C.		132,300	132,300	294,000
S. Norfolk, Va.		148,000	148,000	331,000
Stanberry, Mo.		32,500	32,500	71,607
Wellington, Kans.		57,202	57,202	127,116
Winnemucca, Nev.		54,360	54,360	120,800
Total	$1,940,000	$8,083,777	$10,023,777	$17,968,011

Power-Water

	Loan	Grant	Total	Estimated Cost
Columbus, Neb.	$1,273,000	$1,041,000	$2,314,000	$2,314,000
Iowa City, Iowa		29,250	29,250	65,000
Lakeland, Fla.		18,540	18,540	41,200
State of Nebraska	765,000	625,909	1,390,909	1,390,909
Seattle, Wash.		3,000,000	3,000,000	7,185,000
Valley Co., Neb.	916,000	749,000	1,665,000	1,665,000
Washington, N. C.		64,500	64,500	144,500
Total	$2,954,000	$5,528,199	$8,482,199	$12,805,609

Electric Distribution

	Grant	Total	Estimated Cost
Morning Sun, Iowa	$10,545	$10,545	$24,545
Fayetteville, Tenn.	67,050	67,050	149,000
Total	$77,595	$77,595	$173,545

Light Plant

	Grant	Total	Estimated Cost
Portland, Ind.	$87,000	$87,000	$193,000
Cabool, Mo.	22,900	22,900	50,900
Total	$109,900	$109,900	$243,900

Power Improvement

	Grant	Total	Estimated Cost
Detroit, Mich.	$21,105	$21,105	$46,900
McCook, Neb.	101,300	101,300	227,300
Total	$122,405	$122,405	$274,200

Water-Light

	Grant	Total	Estimated Cost
Poplar Bluff, Mo.	$20,025	$20,025	$44,500

tions. He became president of Detroit Edison in 1913 after having served in various positions with the company and its predecessor.

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TVA Prepares Appeal on Injunction Decision

A fight against the temporary injunction, signed last week by Federal Judge John J. Gore in Knoxville, Tenn., limiting the expansion of the electric power activities of the Tennessee Valley Authority is being prepared, according to James L. Fly, T.V.A. solicitor. The injunction was granted nineteen operating utilities who sought to restrain the T.V.A. from further extending its power activities in subsidized "unfair" competition with them.

Mr. Fly declared that "we are working on an appeal now and will prepare it as expeditiously as possible." He said that an appeal would be filed with the Federal Circuit Court of Appeals at Cincinnati.

Under the injunction the T.V.A. can complete $3,158,932 worth of transmission lines and sub-stations now being built, but it is not allowed to serve customers not already using power generated by the T.V.A. Rural co-operatives served by the T.V.A. are permitted, under the injunction, to acquire additional customers if an extension of the main lines is not required. The effect of the injunction is to "freeze" T.V.A. power activities to work already under way. It prevents the government power agency from further invasion of territories now served by private electric utilities.

•

Niagara Falls Power License Is Protested

Proponents of the St. Lawrence seaway-hydro-electric project have moved to gain a distinct advantage in the fight to obtain ratification of the pact in the next Congress. The New York State Power Authority filed last Saturday with the Federal Power Commission a protest against granting a permanent license to Niagara Falls Power Company for diversion of additional waters from the Niagara River for power generation.

The action of the New York State agency was seen as the first move by Roosevelt forces to suppress opposition to the ratification of the St. Lawrence treaty with Canada by public utility and private interests who are charged with influencing its defeat in Congress. President Roosevelt has always been a strong backer of the St. Lawrence project. Administration forces are now at work in rounding up sufficient votes to insure its passage.

Frank P. Walsh, chairman of the Power Authority, charged that "private power interests" had blocked ratification of the treaty in 1933 and 1934 and that those same "interests" had recently been seeking to form an alliance with private power interests in Quebec to prevent ratification on both sides of the border.

In opposing the application of Niagara Falls Power for a permanent license to divert an additional 275 cu.ft. of water a second around Niagara Falls for power purposes Mr. Walsh stated that "the gift of additional diversion at Niagara Falls to private interests cannot be sanctioned without delaying the development of St. Lawrence power, seriously diminishing its potential value in co-ordination with other undeveloped water powers and strengthening the grip which this powerful combination of interconnected private corporations is attempting to retain upon the natural resources which rightfully belong to the people."

Mr. Walsh said that "2,500,000 hp. of cheap hydroelectric energy is at stake and with it the hope of the people of the northeastern section of the country that the vast potential value of this power will be reflected in the lowest possible rates to homes, farms and small undertakings instead of in the monopoly profits of the power companies themselves and such giant industrial corporations as the Aluminum Company of America and E. I. du Pont de Nemours."

Objections to the fact that Niagara Falls Power Company has only seventy-three customers and that "these customers are securing all of the American share of Niagara power under contracts which are practically free from any effective governmental control or regulation," was made by Mr. Walsh.

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North American Units Plan Major Additions

Electricity had a more prominent role in American life during 1936 than ever before, according to James F. Fogarty, president of North American Company. "Its increased use, both in greater quantities and in new applications, reflected continued improvement in general business," he said.

While final figures for subsidiaries of North American are not yet available, Mr. Fogarty stated, it is estimated that their electric output for 1936 was more than 10 per cent above the previous year. Aggregate sales to customers in the major classifications, residential, industrial and commercial, established new records for the present subsidiaries, he said. It was pointed out by Mr. Fogarty that residential customers now total about 1,020,000 for the four groups of subsidiaries, which operate in territories centering in Cleveland, Milwaukee, St. Louis and Washington, D. C. These customers, he said, used an average of more than 875 kilowatt-hours during 1936 and the average price was approximately 3.58 cents a kilowatt-hour.

Gross expenditures for additions to plants and systems of North American subsidiaries during 1936 totaled approximately $16,000,000, compared with $14,800,000 during 1935. Construction expenditures for the past year were principally on account of transmission and distribution facilities. While generating facilities are ample for present requirements and for expected increases during 1937, Mr. Fogarty stated, major additions are now in progress in anticipation of continued increase in demand and are scheduled for installation in 1938.

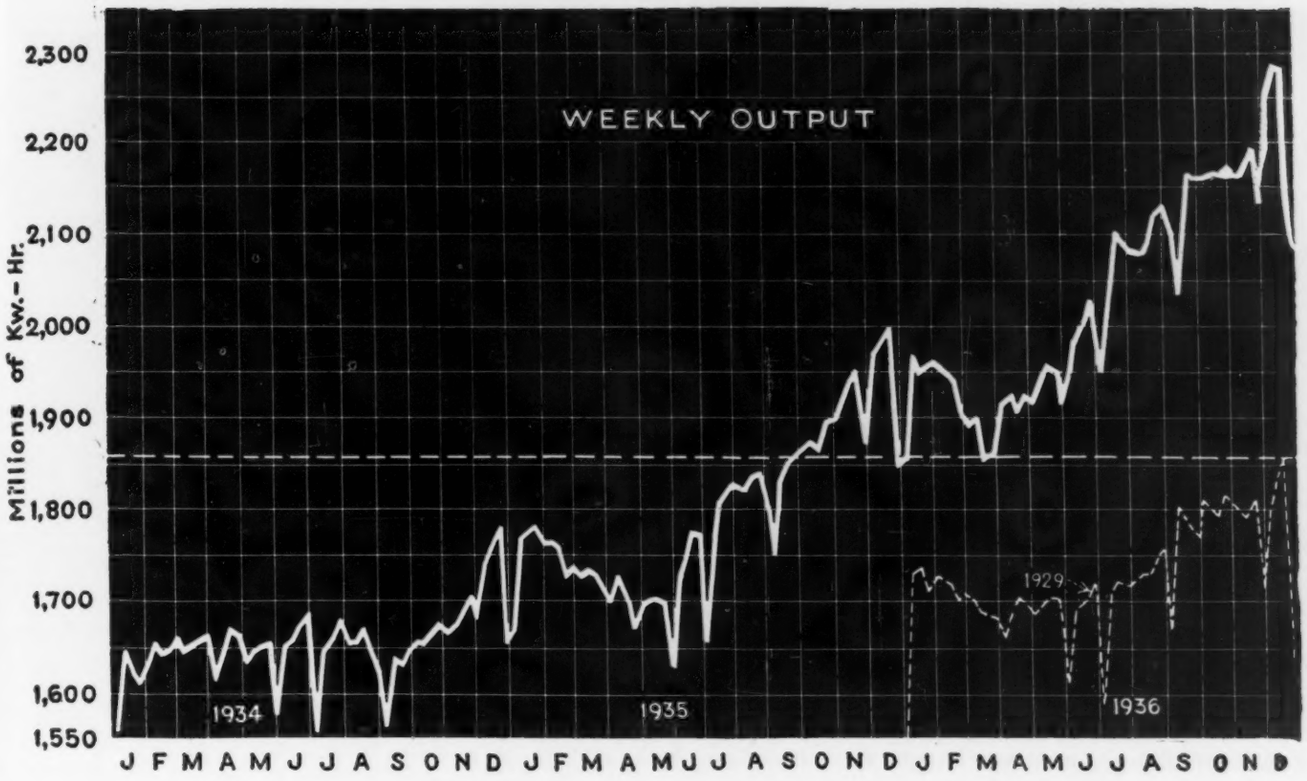
Meetings

American Engineering Council—Annual meeting, Mayflower Hotel, Washington, D. C., January 14-16. Frederick M. Feiker, executive secretary, 744 Jackson Place, Washington, D. C.

American Institute of Electrical Engineers—Winter convention, New York, N. Y., January 25-29. H. H. Henline, national secretary, 33 West 39th Street, New York, N. Y.

National Electrical Manufacturers Association—Midwinter meeting, Waldorf-Astoria Hotel, New York, February 14-18. W. J. Donald, managing director, 155 East 44th Street, New York.

Output Registers Effect of Holiday



Electrical energy production during the week ended December 26 performed as is usual in the holiday week, by plunging 195,000,000 kw.-hr. from the preceeding week's output to 2,080,945,000 kw.-hr. The recession was somewhat larger than last year, when it amounted to 155,000,000 kw.-hr., and evidently reflects the effect of including Saturday morning in the holiday period and thus making a long week-end. Compared with 1935 there was, nevertheless, an increase of 12.7 per cent, and of 27 per cent compared with 1929.

Weekly Output, Millions of Kw.-Hr.

1936	1935	1934
Dec. 26..2,081	Dec. 28..1,847	Dec. 29..1,650
Dec. 19..2,275	Dec. 21..2,002	Dec. 22..1,788
Dec. 12..2,278	Dec. 14..1,983	Dec. 15..1,767
Dec. 5..2,244	Dec. 7..1,970	Dec. 8..1,743
Nov 28..2,134	Nov. 30..1,877	Dec. 1..1,684
Nov. 21..2,196	Nov. 23..1,953	Nov. 24..1,705
Nov. 14..2,170	Nov. 16..1,939	Nov. 17..1,691

The Edison Electric Institute, which reports these weekly figures, states that regional comparisons are not yet available. The usual table showing changes by geographical regions is therefore omitted.

Power Projects Show Increase During Year

Marked progress in the new activities entrusted to the Federal Power Commission by the Congress was made during the past year, according to the annual report of the commission. Increased activity in the various functions which have been performed for sixteen years was also reported.

The commission reported that since 1920 a total of 1,402 applications for licenses or preliminary permits for water-power projects have been filed. The total primary capacity of projects for which licenses had been granted or for which applications were pending on October 31 was approximately 4,082,274 hp., with estimated ultimate installation of 12,325,913 hp.

At the end of the fiscal year June 30, 1936, there were under jurisdiction of the commission, requiring accounting supervision, 118 licensed projects having an aggregate claimed or estimated cost of $674,945,545, a net increase over 1935 of $19,274,013. During the year there was collected from licenses $584,122. The commission also collected $9,506 from the sale of other publications.

The commission is now engaged in division of the country into regional districts for the voluntary interconnection of generating and transmission facilities, action upon applications for mergers and sales of utility properties, is exercising jurisdiction over security issues and supervising rates and charges for electric energy transmitted over state lines in addition to other duties as set forth in the Federal Power Act of 1935. One of the main features of the new powers of regulation is the adoption of a uniform system of accounts for utilities.

The commission has reorganized its staff and has established regional offices in five cities.

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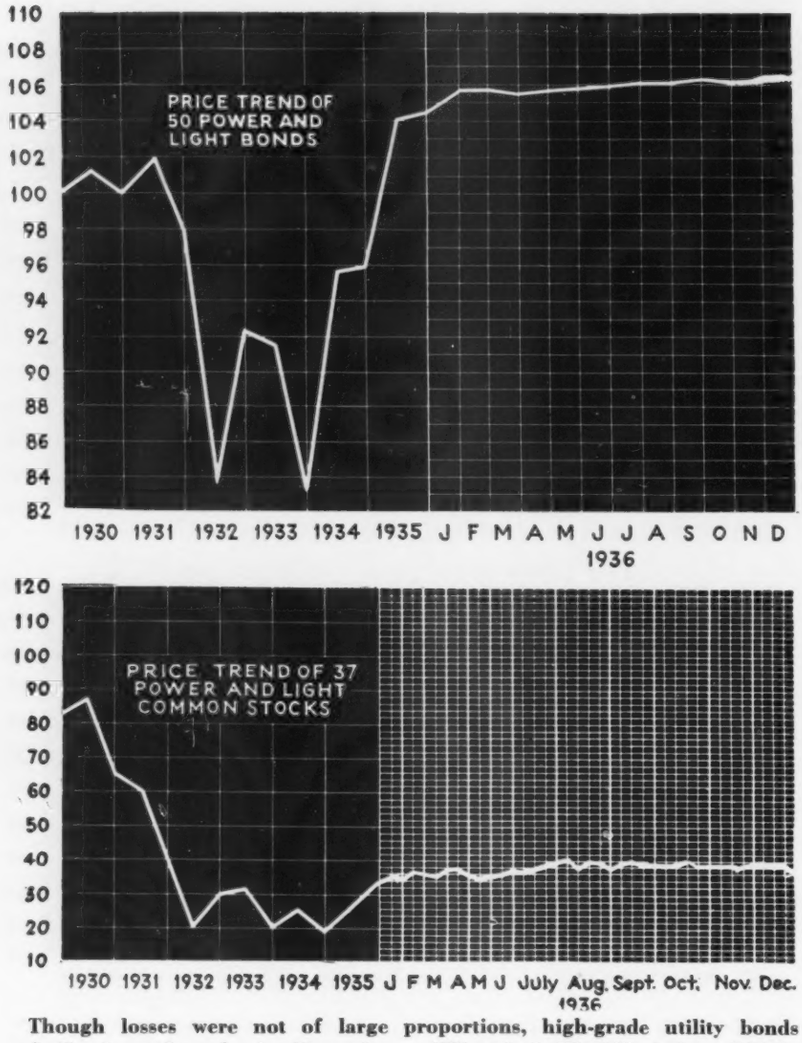
Utility Offers Bond Issue

A new issue of $1,042,800 of first mortgage, series A, 4½ per cent sinking-fund bonds of the Edison Sault Electric Company was offered this week at 101½ per cent and accrued interest. Proceeds will be used for refunding outstanding issues.

Utility Securities Recede Slightly



Though losses were not of large proportions, high-grade utility bonds declined moderately in December. "Electrical World" index, 106.1; November, 106.3. Stock index stood at 37.3 for the last week in December

Utility Wins Appeal Before State Court

Order of the Missouri Public Service Commission directing the Empire District Electric Company of Joplin to restore $1,600,000 to its depreciation reserve fund was overruled recently by the State Supreme Court, division one. Judge William F. Frank wrote the opinion in the case, which was an appeal taken by the electric company from the Cole County Circuit Court, in which the order of the commission had been upheld. He declared the commission had no power to make a retroactive order.

In an audit made by the commission in 1935 it was disclosed that Empire District had transferred $1,600,000 from its depreciation reserve fund to surplus and special surplus reserve accounts over a period of several years of operation.

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Utilities File With S.E.C.

The following have filed applications with the S.E.C. for the registration of securities:

Pacific Gas & Electric Company, $35,000,000 of first and refunding mortgage bonds, series 1, 3½ per cent due June 1, 1936, issued. New York Stock Exchange.

Consolidated Gas, Electric Light & Power Company of Baltimore, $23,000,000 of series N, 3¼ per cent first refunding mortgage sinking fund bonds, due December 1, 1971, issued. New York Curb Exchange.

Registration statement has been filed by the Associated General Utilities Company, Jersey City, covering $5,000,000 of income debentures due in 1961 with interest cumulative at the rate of 4 per cent, subject to certain provisions of the indenture, and 250,000 shares of no-par value common capital stock.

Rochester Gas & Electric Corporation has filed a statement, covering $15,000,000 of general mortgage twenty-five-year 4 per cent bonds, series F, due September 1, 1960, which had been sold privately, and $3,000,000 of general mortgage thirty-year 3¾ per cent bonds, series G, due September 1, 1966. New York Public Service Commission has authorized the Rochester Gas $3,000,000 issue.

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Philadelphia Electric To Refund Obligations

Preparations for the issue and sale of $130,000,000 of first and refunding 3¼ per cent mortgage bonds to mature March 1, 1967, are under way by the Philadelphia Electric Company following the filing of an application with the Public Service Commission of Pennsylvania.

The utility proposes to use the proceeds from the sale of the new bonds to refund its $1,670,000 sinking fund first mortgage 4s, due Oct. 1, 1967; $37,000,000 first mortgage sinking fund 5s, due October 1, 1966; $31,600,000 first lien and refunding mortgage 4½s, due Nov. 1, 1967; $40,000,000 first and refunding 4s, due Feb. 1, 1971; $1,323,000 Suburban Gas Company first mortgage 5s, due April 1, 1952; $18,000,000 of Suburban-Counties Gas & Electric Company first and refunding mortgage 4½s, due May 1, 1957.

It is estimated that the refunding program will effect a gross saving of over $1,000,000 a year in interest charges. The new bonds will be marketed by a nation-wide syndicate headed by Morgan Stanley & Co., Inc.

Philadelphia Electric Company is the principal subsidiary of United Gas Improvement Company.

•

Consolidated Edison Names Seven New Vice-Presidents

At a meeting of the trustees of the Consolidated Edison Company held last week the seven vice-presidents of New York Edison Company, Inc., were elected vice-presidents of New York Edison and other officers of the electric and gas companies that are being merged were elected to positions in the parent company. The new vice-presidents are: Robert B. Grove, Ralph H. Tapscott, A. H. Kehoe, Joseph F. Becker, E. F. Jeffe, Philip Torchio and W. W. Erwin.

Frederick W. Jesser, secretary of New York Edison, became senior assistant secretary of Consolidated Edison. E. J. Rodey, auditor of New York Edison, was made associate controller of Consolidated Edison.

Manufacturing AND MARKETS

Lamp Sales Show Gain of 19% Over Old Peak

Sales of incandescent lamps in the United States will total 880,000,000 for the year, a preliminary report by John Liston of the General Electric Company indicates. This represents an increase of 19 per cent over the high total of 1935.

The outstanding development of the year in lighting equipment was the introduction of two screens, or grids, within a new 1,000-watt lamp to collect much of the blackening formerly deposited on the bulb, according to Mr. Liston. More miles of highway were illuminated during 1936 than in the preceding five years, he said.

•

Will Continue Broadcasts

Because of the ready acceptance by utility customers of the first program of "Songs That Will Never Grow Old," electrical transcriptions for radio broadcast, the Edison General Electric Appliance Company of Chicago has in production an entirely new group of recordings enabling customers to follow up on their first program.

•

Stockholders Give Approval to Nash-Kelvinator Merger

Merger of the Nash Motors Company with the Kelvinator Corporation was approved last week by the stockholders of both organizations. Charles W. Nash, chairman of the board of the Nash company, and also chairman of the new company, issued the following statement:

"The Nash division of the Nash-Kelvinator Corporation will continue to manufacture motor cars, while the Kelvinator division maintains its production of refrigerators, diversified household appliances and other temperature engineering equipment. No change is contemplated at present in the personnel or policies of either division."

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Steam Apparatus Prices Up

A price increase of 10 per cent on steam condensers and shell and tube heaters, effective January 18, is announced by the Westinghouse Electric & Manufacturing Company.

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Moloney in Larger Quarters

Reflecting the increase in transformer business is the announcement of E. A. Robertson, vice-president and district sales manager Moloney Electric Company, that the Chicago district office under his charge has been moved from 20 North Wacker Drive to 100 West Monroe Street. More business makes necessary more office space, says Mr. Robertson.

Manufacturers Give Employees Bonuses

Among the companies that paid bonuses to employees last week were the following electrical manufacturers:

Westinghouse Electric & Manufacturing distributed more than $600,000 on December 23 to employees in all plants and offices of the company. Payments were based on length of service. This distribution was the closing feature of the company's Golden Jubilee Year, marking the fiftieth anniversary of its founding. The announcement concerning the bonus was made at the company's offices, 150 Broadway, New York.

Line Material Company, South Milwaukee, Wis., paid a cash bonus to its hourly employees in all its plants. The bonus consists of amounts ranging from one-half day's pay to two week's pay, depending upon length of service. Approximately 600 workers benefited.

The W. N. Matthews Corporation paid $14 per share dividend on the outstanding preferred stock of the corporation to all preferred-stock holders of record as of December 19. Claude L. Matthews, vice-president and treasurer, advises that during the year 1936 every employee of the corporation received in salary or wage bonuses five weeks extra pay.

SHOWROOM ON WHEELS—Over 13,000 miles through nineteen states and the District of Columbia in nine months this motorized display of electrical connectors has been shown to more than 200 utilities, railroads, contractors, etc., by Burndy Engineering Company, Inc., of New York.

Third Ohio Safety Highway In Operation Near Sandusky

Ohio's third lighted "safety educational highway" is now in operation along a 1-mile section of Route 2 outside Sandusky, and the Ohio State Safety Council has taken one more step toward its goal of 48 such highways in various parts of the state. Opened recently at formal dedication ceremonies sponsored by the Erie County Auto Club, it is similar to other illuminated sections recently put in operation near Canton and Dayton.

A sodium safety lighting system is furnishing adequate visibility along this 1-mile stretch. Twenty-four 10,000-lumen General Electric units have been installed.

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Weston Electric Earns 73 Cents Class A Share

Weston Electrical Instrument Corporation and its domestic subsidiary reported for the first nine months of 1936 a net profit of $161,885 after depreciation and federal income taxes. After dividend requirements on the $2 cumulative participating Class A stock, the profit was equivalent to 73 cents each on 160,583 no-par shares of common stock. In the nine months to September 30, 1935, earnings of $154,968 equaled 64 cents a common share.

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Electric Indicator Installed

An electrically lighted wind indicator twenty-two feet long has been installed at the Lambert-St. Louis flying field in St. Louis (Mo.) County. Arch W. League, chief dispatcher at the airport, declared that airplane pilots have reported that they could see the instrument from an altitude of 15,000 feet and from any angle. The giant arrow is operated by an electrically driven geared motor and is faced on the upper side with a double row of neon tubing giving a greenish light.

New York Metal Prices

	Dec. 22, 1936 Cents per Pound	Dec. 29, 1936 Cents per Pound
Copper electrolytic	11.00*	11.625*
Lead Am. S. & R. price	6.00	6.00
Antimony	12.75	13.25
Nickel ingot	35.00	35.00
Zinc spot	5.825	5.825
Tin Straits	51.90	52.25
Aluminum, 99 per cent	19—20	19—20

* Delivered Connecticut Valley.

Field Reports on Business

Stimulated by the greatest outpouring of dividends, bonuses and salary increases since the start of the depression, retail trade for the Christmas season just passed reached the highest total since 1930. Electrical appliance sales were among the features, running well ahead of last year. Reports from the field to the ELECTRICAL WORLD *indicate that general business is highly optimistic, with hope running high for activity of even a greater pace than during the past few months.*

NEW ENGLAND

New England buying during the past week was spotty. One nationally known manufacturer reported that the sales volume of last week reached a peak for the year; small motor sales lead at a rate about 15 per cent over the closing month of 1935 and an average increase reported throughout this area will be about 30 per cent as compared with last year. Small motors ranging from 1 to 10 hp. continue to be in demand for individual drive machines; switch and control apparatus sales are steady.

Central station supplies are moving well. Line materials are less active in this area due to weather uncertainties, although some outside work is ahead, as in the case of a power line extension to mills within the district served by the Hudson (Mass.) Municipal Light and Power Department and service connections for the U. S. Housing Project known as Old Harbour Village, South Boston. Construction of New Towne Court, costing $2,270,000, consisting of 294 apartments in which electric refrigeration and ranges will be used, is progressing.

Miscellaneous electrical equipment sales cover a wide range and include mobile electrical instruments for hospital service amounting to about $3,500; installation of electrical appliances for counter service which will use 1,902 kw.; awards for repairs for turbo-alternator to the General Electric Company for $3,012 and for inspection service for turbo-generator at $1,050 to the same company.

Merchandising records for the past five years were broken during the past week. According to one prominent distributor radio sets returned to a prominent place among leading electrical equipment sales; household appliance sales went over the top with wide margins as compared with last year.

CHICAGO

Holiday interruptions slowed the tempo of business activity last week. With many organizations taking extended holidays and numerous industrial plants curtailing operations for year-end inventory purposes, indices registered a sharp decline. However, the flood of funds poured into the hands of wage earners and stockholders resulted in the largest volume of buying since 1928. Retail sales in Chicago stores registered substantial gains over the previous month's record and far surpassed last year.

Reports from various fields indicate that, following the current normal decline, an early pick-up is anticipated. The opinion of many in authoritative positions is that activity on all fronts will increase at an even greater pace than during the last few months. Optimism abounds in all fields.

The flood of orders for diversified electrical products seems undiminishing. Appliance sales, with the added holiday buying, are exceptionally high. Wiring devices are in steady demand. Manufacturers of heavy apparatus report difficulty in filling orders, due to material shortages. Indications are that the year-end reports will find lighting equipment sales the highest in six years.

NEW YORK

Seasonally adjusted indices of department store volumes for the month of December should reach another new high for the recovery. Sales for the month will reflect an increase of 12 per cent or more over the 1935 level.

Electrical appliances during the holiday season sold well ahead of last year. Manufacturers found themselves completely sold out of certain items, particularly those falling in the electrical gift category, such as table appliances.

PACIFIC COAST

Two excellent weeks immediately preceding the holidays brought December business to a good level, and although it, like November, reflects the maritime union strike, still there will apparently be no large overstocks of seasonable merchandise, though some wholesalers are holding roughing-in material for large buildings delayed by non-arrival of construction steel. Government work is limited to small jobs, but there is close to $7,000,000 of P.W.A. projects in operation or scheduled for early work in northern California alone. There are $4,000,000 of schools, including $700,000 not yet awarded. Bakersfield with $325,000 and San Francisco with $500,000, still pending, are the highspots. There are also $1,500,000 of piers in the Bay district, including the Dollar Pier recently destroyed by fire and imperiling strikebound steamers. Bids for first units of Sacramento airport have just been received. California state buildings valued at $6,000,000 are budgeted for the next two years, including $1,000,000 for hospitals for immediate construction.

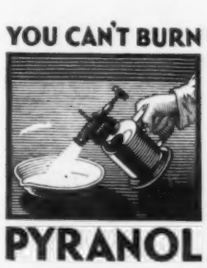
Especially marked is the increase of electrical maintenance material for industrial plants, it being estimated that employment in such plants has increased 8 per cent over last year, with a 30 per cent payroll and a 20 per cent earning increase, as compared with increased percentages of 16, 18 and 2 per cent, respectively, for the comparable heating and plumbing industry.

Copper prices are jumping so rapidly as to have delayed regular price sheet issue and new rubber-covered prices in early January will probably reflect a 15 per cent increase instead of 6 per cent as originally estimated. New electrical equipment for theaters covers twelve under construction, with about 50 undergoing electrical overhauling along the coast, this work being stimulated by desirability of inclusion under 1936 business.

YESTERDAY THIS WAS IMPOSSIBLE

YOU could not put a transformer in the middle of a busy factory floor with only a metal fence around it—yesterday. Today, you can, and save money in doing it. You need not build an expensive fireproof vault. You can save floor space. Long runs of secondary copper are unnecessary, since the transformer can be located adjacent to the load center. Voltage regulation is improved; over-all losses are decreased.

Why, you may ask, can these savings be made today, when only yesterday they were thought impossible? Because of Pyranol, the remarkable noninflammable and nonexplosive liquid dielectric developed by General Electric for cooling and insulating transformers. Because the National Electrical Code, recognizing Pyranol, permits Pyranol transformers to be installed indoors with many of the restrictions applying to oil-filled transformers removed. And, finally, because a Pyranol transformer installation will operate reliably, as evidenced by the record of more than 500 of them—many installed for more than five years—all giving excellent service.

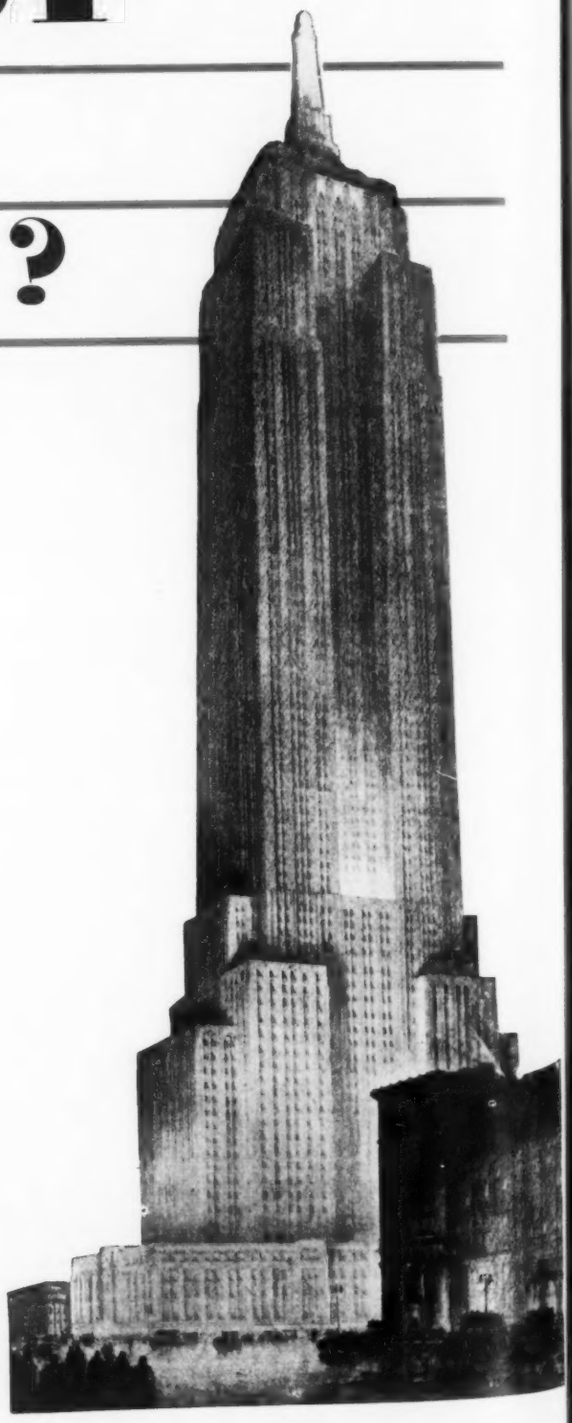


You can obtain further information about Pyranol transformers by writing for Bulletin GEA-2048, or by calling the nearest G-E sales office. General Electric, Schenectady, N. Y.

300-39

GENERAL ELECTRIC

HAS "LARGEST" ANY SIGNIFICANCE?



It has often been said, sometimes disparagingly, that Americans are devoted to the idea of bigness and are prone to attach undue significance to statistics or achievements that are "tops" in their class.

Nevertheless, in certain fields of human endeavor, the term "largest" is frequently a significant indicator both of high achievement and new value. For example, the progress in equipment design and manufacturing techniques that has made it possible to concentrate great steam-generating capacity in single units represents real achievement. Such units have made possible substantial economies in space, investment and operating cost per unit of output.

The problems involved in designing and building large steam-generating units are of unusual magnitude and complexity. Few organizations have the experience, personnel and manufacturing facilities required for their satisfactory solution.

The following résumé of the facts concerning such units indicates the position Combustion Engineering has attained in this class of work.

1 ***Only six boilers have been installed throughout the world which have operated at rates of 1,000,000 or more lb. of steam per hr. Four of these are complete CE Units. Combustion Engineering is now installing its fifth 1,000,000-lb. unit and has recently completed the installation of a unit designed to produce 900,000 lb. per hr.***

2 ***There are 35 boilers in the United States which have produced steam at rates of 500,000 or more lb. per hr. 22 of these are CE Boilers, most of which have CE furnace, firing and heat recovery equipment. Combustion Engineering now has on order eight additional units in this capacity class.***

Every CE installation is engineered and built to assure, as far as possible, the best economic results which can be justified for the particular conditions. An adequate line of boiler, fuel-burning and related equipment, modern manufacturing facilities and an exceptionally competent engineering staff are combined to this end. Capacities of CE installations range from 1000 to over a 1,000,000 lb. of steam per hr.

C·E

COMBUSTION ENGINEERING COMPANY, INC.

200 MADISON AVENUE, NEW YORK

Canada: Combustion Engineering Corporation, Ltd., Montreal

A-334

BOILERS · STOKERS · FURNACES · PULVERIZED FUEL SYSTEMS · HEAT RECOVERY EQUIPMENT
FABRICATORS of PRESSURE VESSELS, TANKS, etc., WELDED or RIVETED in CARBON, ALLOY or CLAD STEELS

New ENGINEERING IDEAS

Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Model Tests for Swiss Hydro Plant

The Thoune Electricity Works planned the addition of a Kaplan turbine to its existing two Francis turbines. Two problems needed to be solved: It was necessary to determine the maximum quantity of water the third turbine could utilize, and then to determine whether the existing width of the canal was sufficient for this quantity. Since it was believed that these problems could be solved more easily by model tests than by calculations and theoretical considerations, the model of the works, shown diagrammatically in the illustration, was built by the Escher-Wyss laboratories (*Escher-Wyss News*, April-June, 1936, Zurich).

Examinations were made of the conditions of flow under three operating conditions—with existing water quantities, with the proposed turbine utilizing the same quantity of water as the two others, and with this turbine utilizing a greater quantity—with both the existing and the maximum width of the headrace, and with any possible arrangements and alterations of the existing shapes of the piers at the intakes to the turbine chambers. To judge this flow better, it was attempted to obtain these conditions:

1. At equal loading the water levels in the three turbine chambers should, as far as possible, be the same.
2. The level of water at the inlet to the small industrial canal should correspond approximately to the continuation of the line showing the loss of head in the large head race.
3. As far as possible, no back or eddy currents should be produced in the turbine chambers or behind the piers, especially in the open sluices.

A topographical survey of the surface of the water was also made, and the flow was made visible at the surface, by means of floating particles and at the bed, by sawdust carried along by the current and by small flags immersed in the current.

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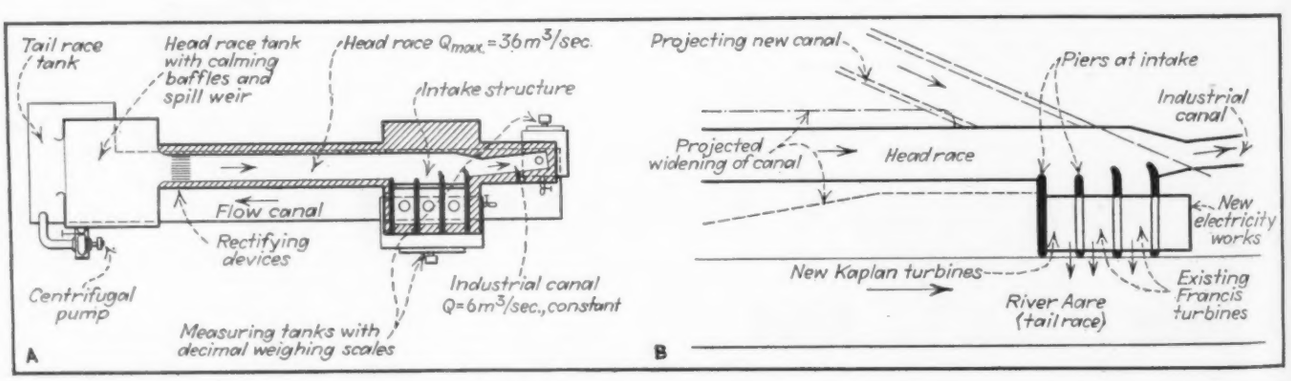
Electric Calorimeter Cuts Testing Time

By J. L. DITZLER
Air Conditioning Division, Westinghouse Electric & Manufacturing Company, East Springfield, Mass.

When testing air-conditioning condensing units many accurate readings must be obtained at various combinations of suction and discharge pressures. Therefore, in order for any system to be satisfactory it must be accurate, flexible and possess ease and speed of operation. An electric calorimeter developed by the Westinghouse company to obtain performance data on air-conditioning condensing units meets all of these requirements.

This calorimeter converts electrical



Model simulates plant problems

Model consisted essentially of: (1) Headrace tank, serving to calm regulated flow of water delivered by centrifugal pump; (2) headrace, and (3) model trough, containing reproductions of turbine chambers, piers and inlet end of small industrial canal. Constructed on linear scale of 1:25. Complete plant had length of 7 m. (nearly 23 ft.); of this, about 4 m., corresponding to 40 m. of headrace, were exactly to scale, as also front part of power house and 16 m. of industrial canal. Walls and containers of model of wood, and cement used for all portions which it was anticipated would not have to be altered. In model chambers, turbines were replaced by pipes, and regulating valves provided at outlets of chambers. (A represents model; B, layout of the plant.)

WHY YOUR LINEMEN WILL LIKE

genuine Kearney CON-NEC-TITES

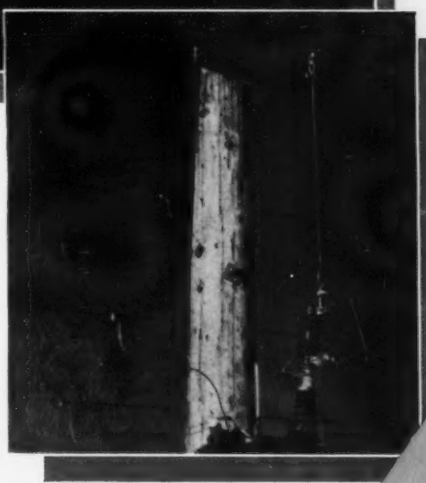
- EASY-START THREADS
- STURDY CONSTRUCTION
- FULL ROUND WASHER

Linemen aren't troubled with nuts binding or cross threading on Kearney Con-Nec-Tites. That can't happen because there's a thread "lead pilot" on each leg of the bolt and full, uniform threads run clear to the end of the bolt.

And when it comes to sturdy construction, as pioneers of solderless connectors, we've found, in our research, the proper material to give strength plus electrical efficiency.

Yet, there's another feature—the patented full-round washer. It distributes the load on the nut and produces full pressure between the conductors.

It has been these features, coupled with others, that have gained the approval of linemen everywhere and have, no doubt, been a major factor in making Kearney the world's largest producer of solderless connectors.



● *With 75 standard Kearney Con-Nec-Tites available, you can handle just about any connection you wish to make. Note the use of Con-Nec-Tites on this Kearney Trip-O-Link installation.*

JAMES R. KEARNEY CORPORATION

DESIGNERS AND MANUFACTURERS OF OVERHEAD AND UNDERGROUND

UTILITY EQUIPMENT

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SEE HOW MUCH MORE YOU GET IN KEARNEY CON-NEC-TITES

Specify—

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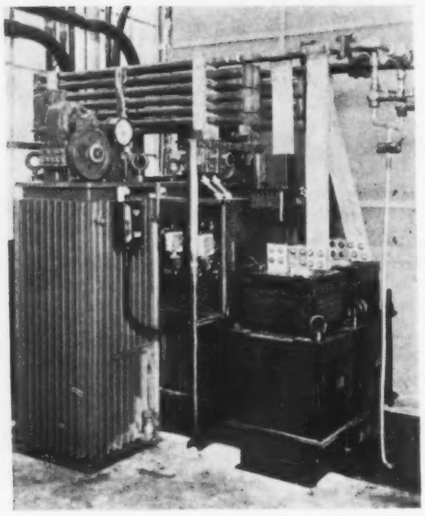
KEARNEY PRODUCTS

Solderless Con-Nec-Tites; Lap-Tite Connectors; Trip Out Fuse Switches, Trip-O-Link Fuse Switches, Dual Trip Out Switches, Trip-Saver Fuse Switches; One and Two-Insulator Fuse and Disconnect Switches, Porcelain Housed Tripomatic Fuse Cutouts, Double Duty Cutouts; Pole Top and Quick-Break Gang Operated Switches; Porcelain Housed Disconnect Switch; Screw Anchors, Expansion Anchors; Guy Wire Clips and Strand Bands; Economy Cable Clamps; Dead-End Service Clamps; V-Groove Service Clamps; Fuses, Fuse Link Boxes, Fuse Pullers; Hitemeters; "J" Hooks; Conduit Straps; Pole Stubbing Seats; ABC Sleeves; ABC Sleeve Machines; Cable Ring Saddles; Fit-Rite Wire Holders; Sleeve Twisters; Underground Boxes; Ground Wire Clips; Ground Rod Con-Nec-Tites; Ground Clamp-Tites; Grounding Cable; Secondary Fuse Holders; Telephone Drop Wire Ties; Hi-Line Tools and Accessories; Con-Nec-Tap Clamps; Grounding Sets; Masterenches; T-Con-Nec-Tites; Full-Vu Guy phone Drop Wire Ties; Hi-Line Tools and Accessories; Con-Nec-Tap Clamps; Grounding Sets; Masterenches; T-Con-Nec-Tites; Full-Vu Guy Guards.

FOR BETTER CONSTRUCTION & MAINTENANCE



Equipment for testing air conditioning condensing units cuts test time

The refrigerant coil is electrically insulated from the rest of the system. Power fed to the heating element is measured by means of an ordinary wattmeter, using a current transformer to bring the current within the capacity of the meter. This wattmeter can also be calibrated in B.t.u's. per hour if so desired.

The heating coil is calibrated for heat loss, or gain, with varying temperature differences between the coil and the air. Wattmeter readings are corrected for heat loss or gains, but this correction is not allowed to exceed 3 per cent of the wattmeter reading.

energy into heat, by using the copper refrigerant-carrying tubing as the heating element, power being obtained from a 220-volt a. c. supply. Energy supplied is varied by regulating the voltage applied to the heating element. This control is obtained by using a voltage regulator which varies the voltage from 0 to 440 volts. Power is supplied to the heating element through a transformer having a voltage ratio of 440 to 13.75. The heating element consists of about 60 ft. of $1\frac{1}{2}$-in. copper tubing, which also serves as the expansion coil for the refrigerant. This construction gives direct contact between the refrigerant and the element supplying the heat.

Refrigerant supply is controlled by means of a hand-expansion valve, which allows free control of the suction pressure. By increasing or decreasing the voltage supplied to the transformer the current in the coils can be increased or decreased at will. In this manner any degree of superheat can be obtained.

Two such coils are used in order to obtain the maximum rating of the condensing units being tested. Each coil is a separate unit itself and when capacity readings in the lower ranges are taken one coil may be entirely isolated from the system by means of a set of valves. Power is supplied through two 75-kva. transformers and ratings as high as 40 tons can be obtained.

•

Line Ground Wires Shield Substation

By B. VAN NESS, Jr.
Electrical Engineer
Pennsylvania Water & Power Company
Baltimore, Md.

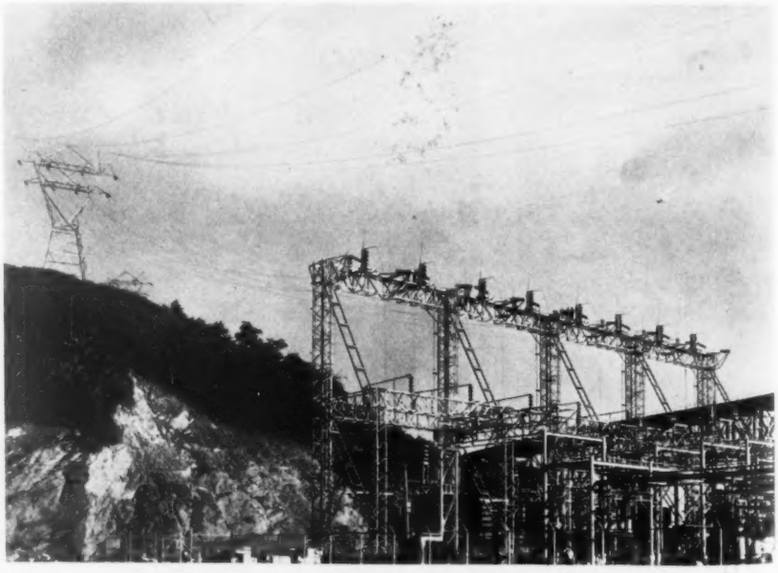
Importance of Conestoga substation of the Pennsylvania Water & Power Company as a link between the Safe Harbor hydro-electric development and a four-circuit, 132-kv. steel tower transmission line supplying single-phase power to the Pennsylvania Railroad substation at Perryville, Md., led to use of a unique shielding scheme to protect the station from direct lightning strokes. This scheme involved extension of the transmission ground wires 90 ft. above the station to form a protective "blanket" that would divert direct strokes from the substation equipment.

Since line air-break switches at Conestoga may be called upon to interrupt the charging current of 100 miles of 132-kv., single-phase transmission line, they have been placed at the top of the substation structure, with phases of each circuit separated 24 ft. and those of adjacent circuits spaced 27 ft. Exposed location of the arcing horns of these switches would have made them a vulnerable target for lightning strokes without shielding. It was therefore considered a design requirement that line lightning protection be continued from the first tower into and over the station.

Protective ground wires could not be terminated satisfactorily on steel above or between the switches without reducing arc clearances. Fortunately the station is located in a deep narrow valley and it was found possible to stretch the ground wires across this valley above the substation from the first transmission tower to H-beams set in the opposite hill. The protective ground wires are tied together at the bases of the H-beams and are connected by buried No. 4/0 copper cable to the substation and power house grounds. The resulting ground system is of high capacity with a resistance of somewhat less than 0.25 ohm.

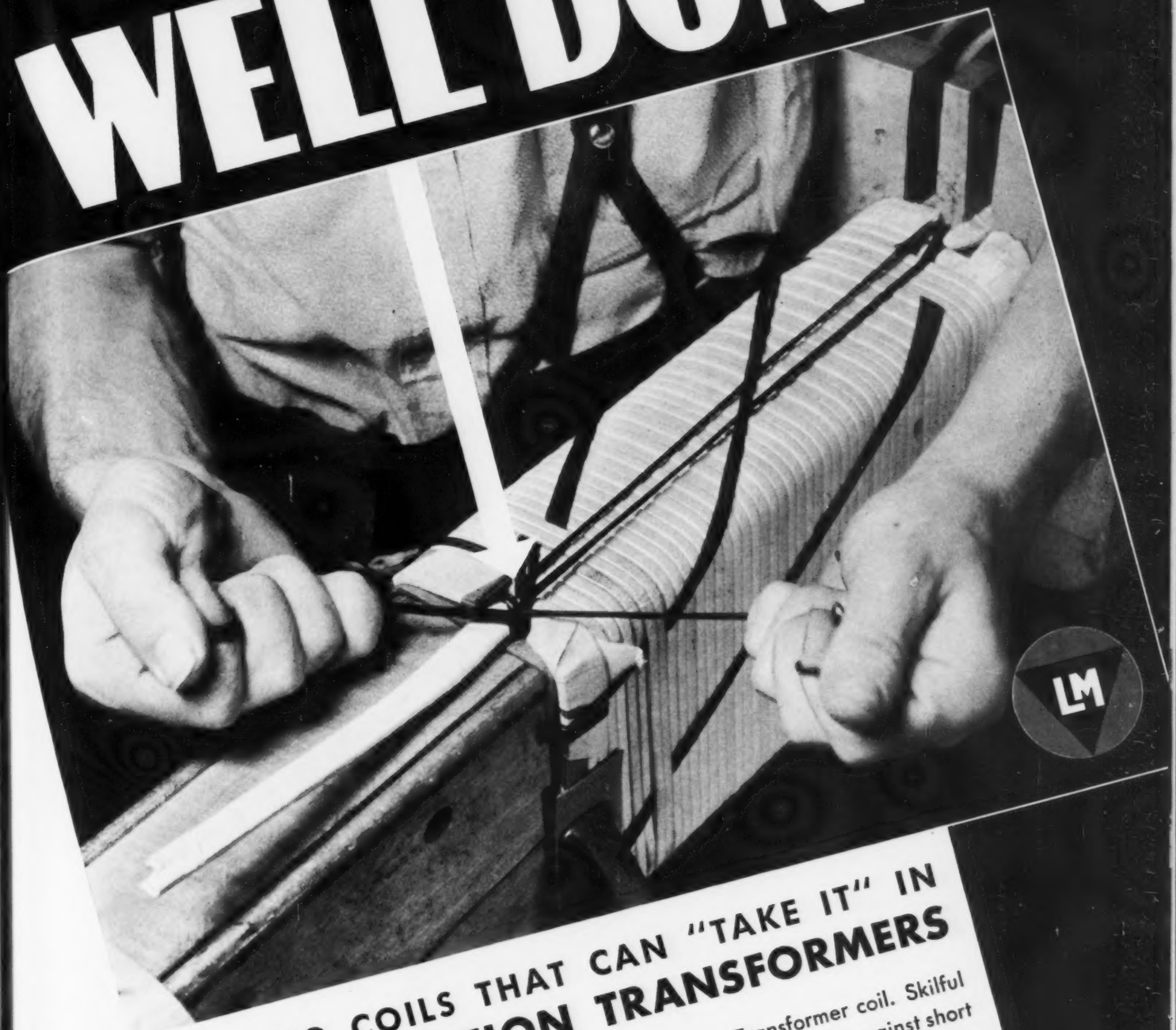
It is expected that rod gaps can be set at sufficiently low values to protect equipment without at the same time causing outages from gap flashovers. Lightning arresters have, therefore, been omitted from the initial installation and the protective gap settings have been reduced to $29\frac{1}{2}$ in. from the 41 in. value which is the co-ordination level of transformer and major high-voltage insulation in this switchyard.

This installation has passed through one lightning season without any flashovers of line, protective gaps or substation insulation despite the fact that surge crest indicators have recorded a number of lightning hits on line ground wire system.



Ground wires stretched across narrow valley shield Conestoga substation from lightning

A LITTLE THING WELL DONE



INSURING COILS THAT CAN "TAKE IT" IN L-M DISTRIBUTION TRANSFORMERS

High mechanical strength is actually "tied" into every L-M Transformer coil. Skilful hands weave stout cords through the secondary winding to reinforce it against short circuit "bumps"... to insure an all-round sturdier coil. This is but one of the "little things well done" throughout L-M Transformer construction to insure better performance and lower maintenance cost. Get full details on the rugged, reliable L-M design. Write to South Milwaukee, Wisconsin, for L-M Transformer Bulletin, LMB 6364.

LINE MATERIAL CO.

News ABOUT PEOPLE

R. W. McClure New President of Oklahoma Power & Water

R. W. McClure, for the past eight years vice-president in charge of operations of the Southwestern Light & Power Company, Chickasha, Okla., has been elected president of the Oklahoma Power & Water Company with offices in Sand Springs. A native of St. Louis, Mo., and a graduate of the University of Missouri, Mr. McClure entered the public utility field in 1921 with the Lawton Gas & Electric Company of Lawton, Okla., predecessor company of the Southwestern Light & Power Company. He served in various capacities until his appointment to a vice-presidency.

•

▶ J. E. M. MITCHELL has been appointed general sales manager of the Jeffery-Dewitt Insulator Company, Kenova, West Va.

▶ W. H. SICKINGER has been appointed by the Crown Stove Works, Chicago, newcomer in the electric range business, to supervise the development and sale of the new product. Mr. Sickinger has been identified with the sale of electric cookery appliances, large and small, for more than fifteen years.

•

General Electric Elects Commercial Vice-Presidents

Five new commercial vice-presidents have been elected by the board of directors of the General Electric Company, it has been announced by President Gerard Swope. They are: M. O. Troy, Schenectady, manager of the central station department; L. T. Blaisdell of Dallas, southwestern district manager; E. H. Ginn of Atlanta, southeastern district manager; A. L. Jones of Denver, Rocky Mountain district manager, and T. S. Knight of Boston, New England district manager.

Left to right: K. H. Gorham, "Electricity on the Farm"; W. E. Welsh, Pennsylvania Power & Light, and R. G. Harvey, Syracuse Lighting, took time out to face the camera. They were attending the sessions of the Northeastern Power Sales Conference, sponsored by General Electric

James F. Lincoln, president of the Lincoln Electric Company, in whose honor his company has named its newly created foundation to encourage scientific development of arc welding

•

▶ WILLIS H. CARRIER, chairman of the board of the Carrier Corporation and a past-president of the American Society of Heating and Ventilating Engineers, has been voted an honorary member of the Japanese Association of Refrigeration, according to a cablegram received from Dr. Masao Kamo, professor of mechanical engineering of the Imperial University, Tokyo, and president of the Japanese association.

▶ H. E. D'ANDRADE has been appointed manager of the lighting bureau of the Brooklyn Edison Company, according to an announcement by Charles L. Harold, general sales agent of the company. The appointment of S. M. Pratt as assistant manager is also announced. For the past few months Mr. D'Andrade has been director of the Edison Wonder House. He joined Brooklyn Edison nearly twelve years ago after serving in the illuminating engineering bureau of

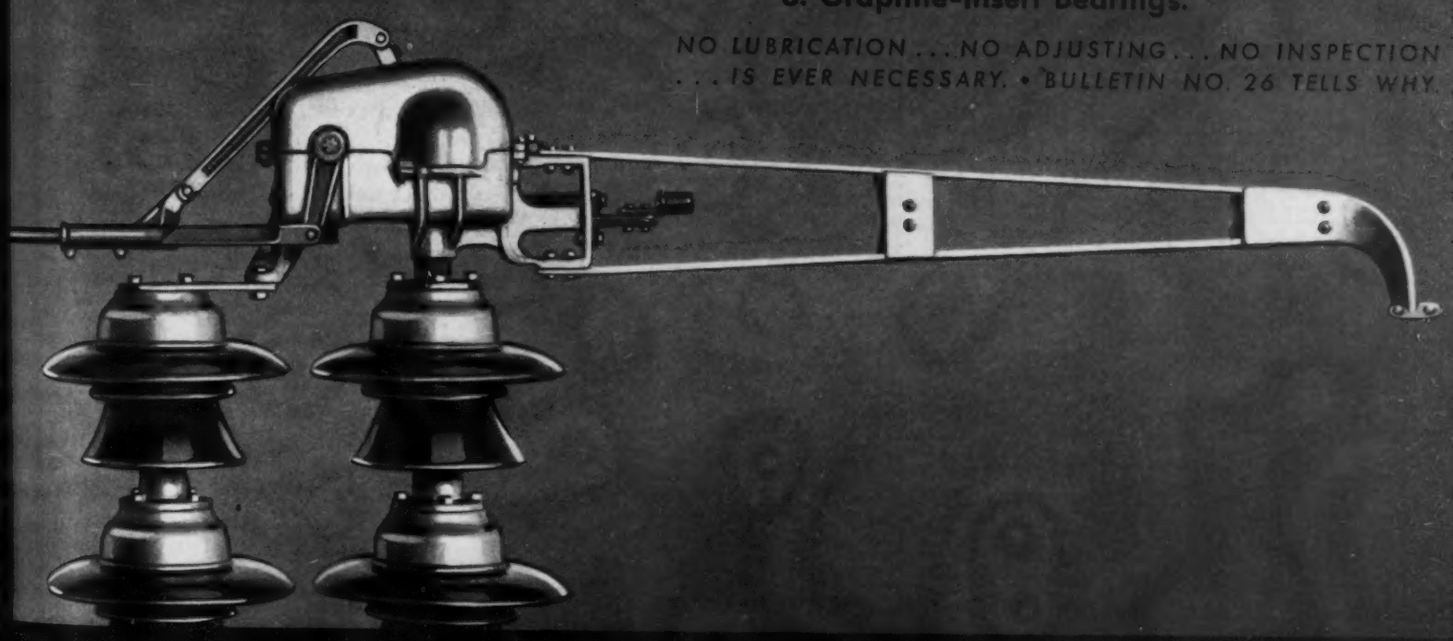
AIR-BREAK SWITCHING

Time was when all we claimed for HI-VOLTAGE was equality with the best competitive Air-Break Switching Equipment.

NOW, HI-VOLTAGE is "Tops." Here are some of the **exclusive** features that assure absolutely dependable service under all conditions, for many years.

1. **Totally enclosed, all-bronze, accurately-machined, operating mechanisms.**
2. **Monel Ball Bearings.**
3. **Graphite-Insert Bearings.**

NO LUBRICATION . . . NO ADJUSTING . . . NO INSPECTION . . . IS EVER NECESSARY. • BULLETIN NO. 26 TELLS WHY.



HI-VOLTAGE EQUIPMENT CO.

2891 EAST 79TH STREET • CLEVELAND, OHIO

the Westinghouse Lamp Company. He has been active in the affairs of the Illuminating Engineering Society, having served on several national committees and two years ago as chairman of the New York section.

•

New England Power Personnel Changes

John B. Mahoney, superintendent of the western division of the New England Power Company system for the past 24 years, has been transferred to the Boston staff of the New England Power Association. Henry A. Suprenant, assistant superintendent of the western division, succeeds Mr. Mahoney as superintendent. Mr. Suprenant's successor will be Harry L. Hurd, western division technical assistant. Philip W. Rancourt has been made superintendent of hydro and mechanical maintenance for the western division. He has been with the system 24 years.

•

► H. B. DAY, formerly a power sales engineer for the Metropolitan Edison Company, Reading, Pa., now is an industrial power engineer for the Pennsylvania Power & Light Company, Allentown, Pa.

► V. R. PARRACK, formerly assistant electrical engineer Tennessee Valley Authority, Knoxville, now is employed by the North Carolina Power & Light Company, Raleigh.

OBITUARY

C. Elmer Smith

C. Elmer Smith, president of the S. Morgan Smith Company of York, Pa., manufacturer of hydraulic turbines, died December 20 at his home near York, in his seventy-fourth year.

In his early youth he worked for a time on surveying parties locating the Oregon Short Line Railroad in Montana and Idaho and then returned to York, his native city, to become connected with the S. Morgan Smith Company. He was president of this company from the time of the death of his father, S. Morgan Smith, the founder of the company, in 1904, to the present time. He was identified with several early hydro-electric plants, but his most important connections were with the early plants in Georgia. When the Georgia Railway & Power Company was organized he became a director and member of the finance committee of that company, remaining until 1929, when it was consolidated with other companies in Georgia into the present Georgia Power Company.

He also served as a director of the Southeastern Power & Light Company from 1925 until 1929, when that company was merged into the Commonwealth & Southern Corporation.

•

► W. S. WALLACE, for many years illuminating engineer of Charles H. Tenney & Company, Boston, and recently district lighting engineer for the New England Power Service Corporation with headquarters at Lowell, Mass., died suddenly at the Somerville, Mass., Hospital on December 1. He was born in Philadelphia in 1897 and was educated at the University of Virginia.

► JOHN JENKINSON, superintendent of the meter department of the British Columbia Electric Railway Company, Vancouver, for the past 37 years, died recently.

► RICHARD DARLINGTON, SR., formerly assistant superintendent of mechanical construction for the New York Edison Company and an associate of the late Thomas A. Edison, died December 22 at his home in Elizabeth, N. J., of a cerebral hemorrhage. He was 70 years old.

► DR. GEORGE FORBES, pioneer in electrical engineering, who was prominently identified with the harnessing of Niagara Falls for the production and distribution of electric power, died at Worthing, Sussex, England, on October 23. He was 87 years of age. When in 1890 the International Niagara Commission, under the chairmanship of Lord Kelvin, invited plans, Dr. Forbes submitted a scheme for the use of alternating current. Although the commission favored direct current, it awarded him a premium and appointed him one of its consulting engineers. Dr. Forbes also achieved distinction as an author and an inventor.

► DAVID H. KELLY, manager of Allis-Chalmers Manufacturing Company's district office at Philadelphia, died at his home in Penn Valley, Pa., December 7. He was born at Steubenville, Ohio, on July 2, 1883. Mr. Kelly entered the employ of the Bullock Electric Manufacturing Company at Norwood, Ohio, about the time that company became part of the Allis-Chalmers Company. He served respectively as sales engineer in the company's Cincinnati, Philadelphia and Washington district offices and at the conclusion of the World War was transferred to the New York office. In July, 1920, Mr. Kelly was appointed to the position he occupied at the time of his death. He was senior vice-president of the Engineers Club of Philadelphia, past-chairman of the Philadelphia section of the American Institute of Electrical Engineers and a member of the board of governers of the Electrical Association of Philadelphia.

ENTR'ACTE AT SALES CONFERENCE—Group in the foreground includes, left to right: A. F. Perry and L. A. Smith of the Orange & Rockland Electric Company, H. I. Sanctuary (half hidden) of Central Gas & Electric and Sherman Sharples of Rockland Light & Power

THE UNIVERSAL CHOICE

. . . Automatic readjustment from Steam Flow-Air Flow Boiler Meter . . . completes Bailey System to insure continuous test results in daily operation

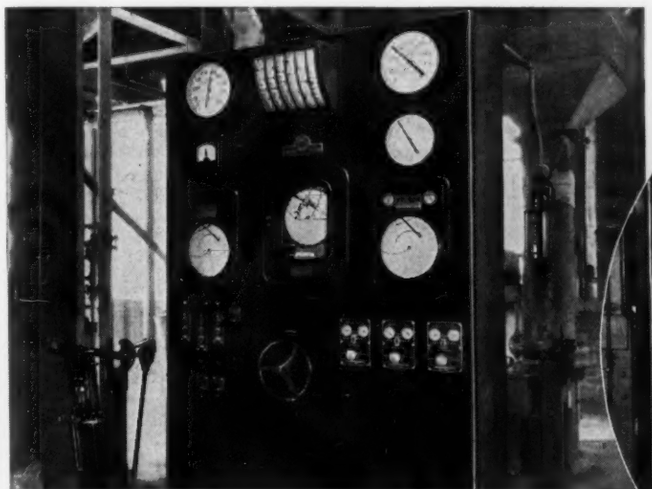
• Complete combustion control with automatic readjustment of Fuel—Air Ratio from Steam Flow-Air Flow is the universal choice of both central station and industrial power engineers alike.

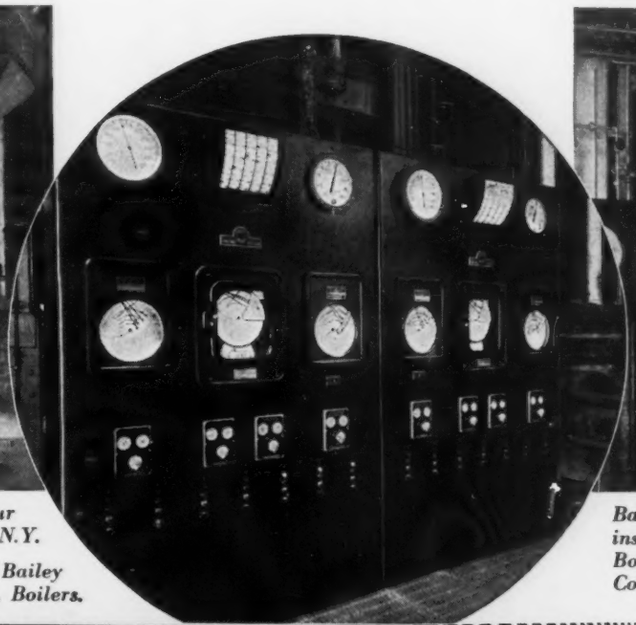
This system not only maintains steam pressure, furnace draft and load distribution among boilers but it also automatically readjusts the fuel or air to maintain maximum combustion economy. Constant automatic control of these factors results in safe, economical and consistent boiler operation.

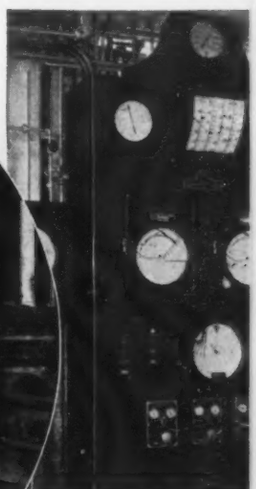
When you purchase new boilers and modern fuel burning equipment, or when you revamp existing equipment, you go a long way toward realizing power profits; but you can never be sure of these benefits unless the modernization program includes metering equipment and COMPLETE Combustion Control.

Write for Bulletin No. 102 describing Complete Combustion Control.

BAILEY METER COMPANY
1060 IVANHOE ROAD • CLEVELAND, OHIO
Bailey Meter Company Limited, Montreal, Canada







ABOVE—*Bailey Meter Control installed on 60,000 lb. per hour capacity boiler at Oldbury Electro-Chemical Co., Niagara Falls, N.Y.*

CIRCLE—*At Hiram Walker & Sons, Inc., Peoria, Illinois, this Bailey Meter Control Panel automatically operates two 1,380 h. p. Boilers.*

Bailey Meter Control installed on 1,328 h.p. Boiler at Scott Paper Company, Chester, Pa.

& CONTROL

SUPERHEAT CONTROL — DESUPERHEAT CONTROL — COMBUSTION CONTROL — FEED WATER CONTROL — BAILEY METERS

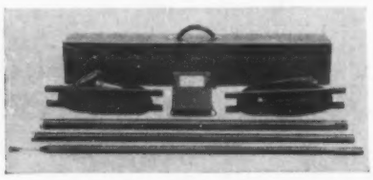
RELIABILITY
FUEL AND MAINTENANCE SAVINGS
SAFETY

TO ECONOMY, SAFETY AND RELIABILITY

New EQUIPMENT AVAILABLE

Insulator Tester

A portable outfit is available for the live-line testing of porcelain disk or pin-type insulators. It consists of a high-resistance Bakelite test stick in three sections, a



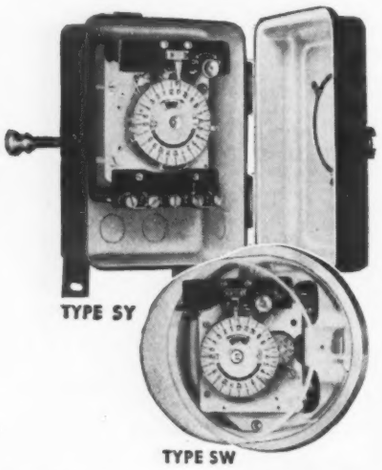
"Hipot;" for operating voltages from 11 to 132 kv. and higher. **Roller-Smith Co.**, New York, N. Y.

handle section carrying one end of the connecting cable, an indicating instrument mounted on a ground prod, connecting cable, connectors and carrying case. The test stick is assembled and the free end of the cable plugged into the indicating instrument, the ground prod being shoved into the ground. After a preliminary adjustment of the meter is made the metal collar between each insulator is touched, giving a gradient of the line to ground voltage.

•

Time Switches

Two models of synchronous-motor time switches are offered which, it is claimed, will control almost any type of a.c. circuit operated on a predetermined time basis.



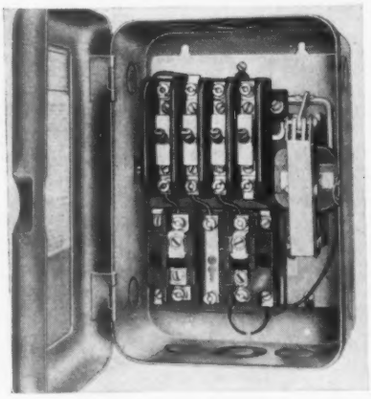
Sauter, Models SY and SW; both offered in 4 or 30 amp. capacity, for 110 or 220 volts a.c.; plain or astronomic dials. **R. W. Cramer Co.**, New York, N. Y.

One model has an all-metal housing. The other, designed for mounting in a standard meter socket, is most frequently used for off-peak water heating and two-rate metering control, although it is equally suited for any type of installation where the metal housing is used, say the makers. Vernier time adjustments permit the switches to be set within one-half minute.

•

Starters

New magnetic starters and contactors employ self-cleaning, self-aligning "wiping" contact action and have all parts assembled on a non-carbonizing, heavy, brack-glazed porcelain base. Complete mechanism of



Type "CM"; for 1½ to 25-hp., single or polyphase motors. **Trumbull Electric Manufacturing Co.**, Plainville, Conn.

both devices, it is claimed, is entirely removable for wiring by loosening three screws, being mounted on a steel backplate. Relay heaters, ½ to 80 amp., are interchangeable one with another on all sizes.

•

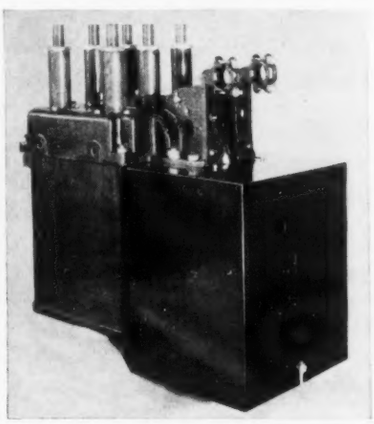
Switches

New 3600 line; obtainable for single or banking installations, with or without branch circuits. **Wadsworth Electric Manufacturing Co.**, Covington, Ky.

Designed as service entrance equipment, new "door-operated" safety switches are announced. Opening the door, which is hinged to the bottom of the cabinet, places the switch in "off" position; closing it, places the switch in "on" position. Main porcelain switch and fuse block, with all wiring terminals on face, is rigidly installed in cabinet and shielded by bakelite-lined steel dead front. Switch blades are angle-formed of wide, heavy-gage copper, seated on porcelain base securely attached to inside of door.

Circuit Breakers

Recently announced solenoid-operated oil circuit breakers, for indoor service, consist of a rectangular top supporting the moisture-proof, micarta bushings, operating levers



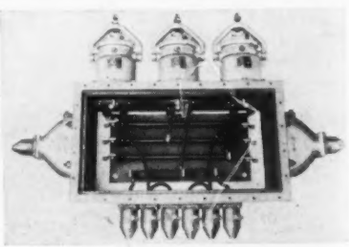
Type F-122; rated at 25,000 kva.; for service up to 600 amp., 7,500 volts and 800 amp., 2,500 volts; two- and three-pole, single-throw. **Westinghouse Electric & Manufacturing Co.**, East Pittsburgh, Pa.

and a welded tank. Operating levers are installed within the breaker chamber to remove them from the vicinity of live contact terminals, thus increasing the electrical clearance to grounded parts outside the breaker. Both manually and electrically operated breakers are available and may be arranged for various mountings. "De-ion" interrupters are also featured.

•

Cable Junction Box

Oil fuse cutouts are mounted directly on this subway cable box. A three-conductor main cable may be carried straight through, with the conductors solidly connected to the busbars. Branch connections are tapped off



Unit uses Type FC oil fuse cutouts, rated at 5,000 volts, 200 amp. maximum. **G & W Electric Specialty Co.**, Chicago, Ill.

ROEBLING

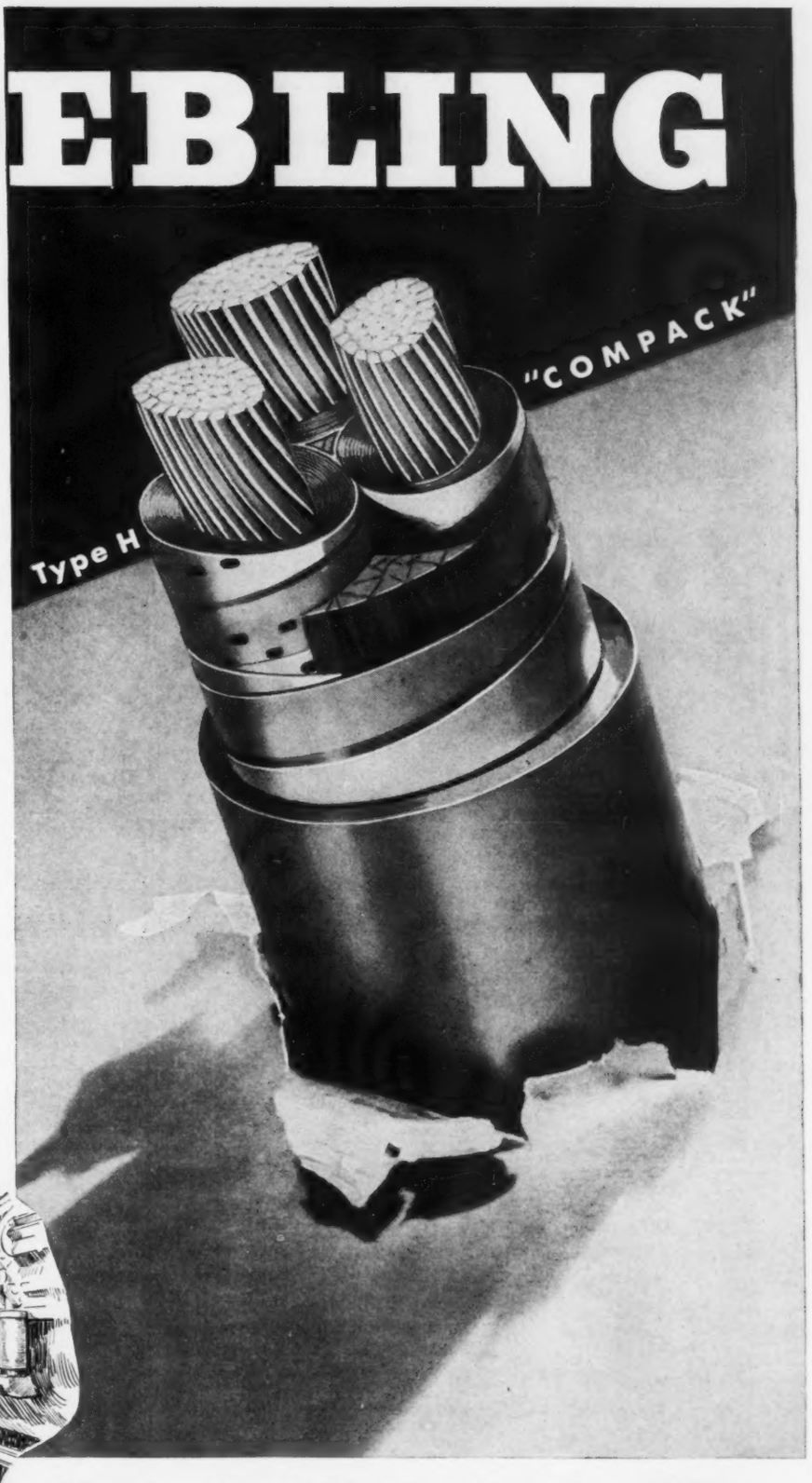
Paper Insulated CABLES

Roebling "Compack" Type H Impregnated-Paper-Insulated Lead Encased Cables with graded insulation are made in single and multiple conductor constructions. Lower voltages cables are unshielded.

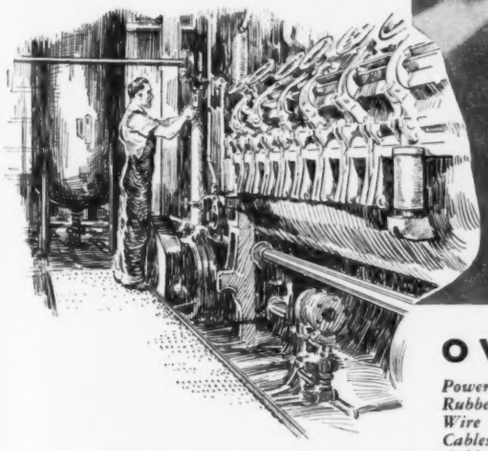
All these cables meet the design, manufacturing, test and guarantee requirements of the High Tension Cable Committee of the Association of Edison Illuminating Companies specifications prepared in consultation with the Insulated Power Cable Engineers Association.

We invite your inquiry on this cable or any of the other types listed.

JOHN A. ROEBLING'S SONS CO.
Trenton, N. J. *Branches in Principal Cities*



This is the latest design unit for filtering, debumidifying and degasifying cable oil—one of many operations to assure maximum quality and uniformity of Roebling impregnated-paper-insulated Cables.



OVER 60 OTHER TYPES

Power Cables: Paper; Cambric; Rubber » Parkway Cable » Tree Wire » Service Cables » Station Cables » Rubber Covered Control Cables » Rubber Covered Wires and Cables: Code; Intermediate; 30% and 40% Performance; 35% and 40% Performite; Plain Rubber 60% Sheath Power Cable and 40% or 60% Sheath Flexible Cords » Weatherproof Wires and Cables » And many other wires and cables.

TRADE MARK JAR REG. U.S. PAT. OFF.

ONLY A FINE PRODUCT MAY BEAR THE NAME ROEBLING

the busbars and connected through the cutouts. Six separate wiping sleeves on the bottom side of the box aid in making connections to a delta-connected bank of transformers.

•

Switches

Two sizes have been added to the company's line of "Fuse-Puller" switches, for

Type "H"; available in 30 and 100 amp. sizes. **Trumbull Electric Manufacturing Co.,** Plainville, Conn.

use in connection with main, range and branch circuit service. They can be supplied with from two to eight plug fuse branch circuits in flush or surface type boxes.

•

Trailers

Two new trailers have been announced that are light, two-wheel units, sturdily constructed and designed for use with ½-ton trucks equipped with pick-up, installation or

Type A-2, rated at 1,500 lb.; Type B-2, rated at 2,000 lb.; chrome nickel steel axle, bearings, standard pneumatic tires. **Highway Trailer Co.,** Edgerton, Wis.

service bodies. Each end of the platform of the trailers is provided with chains and chain tighteners for handling the occasional small load of poles. Removable racks with deep lower panels are standard equipment.

•

Arc Welder

"Wonder Arc"; capacities from 125 to 600 amp.; for 220 volts, 60 cycles, single-phase a.c. **Miller Electric Manufacturing Co.,** Appleton, Wis.

A newly designed portable a.c. arc welder is of a special transformer type with a high power factor, having reactance control, static high-frequency arc and sheet metal attachment that makes possible the welding of light-weight metals according to the manufacturer. They are said to be safe to operate, since there are no electrical connections between the power input and the welding leads, and since they are not of the auto-transformer type they may be used to weld on grounded systems.

Ammeters

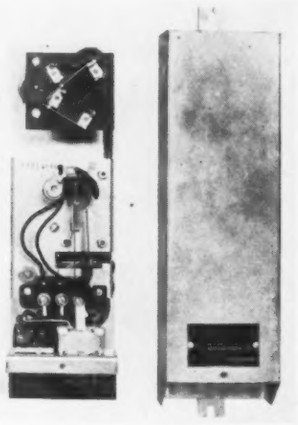
Dual Range Clip-on; available in four low-range, three high-range combinations. **Ferranti Electric, Inc.,** New York, N. Y.

Recent additions to this company's line of Clip-on ammeters make possible the measurement of currents from 1/5 to 1,000 amp. without shutting down equipment or opening the circuit. Features of the earlier models have been retained.

•

Carrier-Current Controller

This new low-frequency carrier-current control is designed to regulate, on a single carrier frequency, both an all-night and a part-night street lamp in the same standard.



Model 4SCS5J1:for mounting in base of lamp standard. **General Electric Co.,** Schenectady, N. Y.

It is said also to be suitable for remote-control applications where it is desired to turn on two devices at the same time but turn off one before the other. Controller is self-synchronized; whenever a 30-second "all off" impulse is transmitted contacts of both loads reset to their normal positions, regardless of their positions at the start of the impulse.

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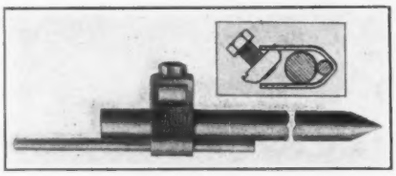
Grounding Connector

New connector of non-corrosive copper alloys has been announced for use in joining a ground lead to a driven rod or pipe. Its construction permits it to be slipped over the top of the rod as a one-piece assembly, or, in case the rod or pipe has been splayed from driving, it may be disassembled and slipped around the conductors. It is in-



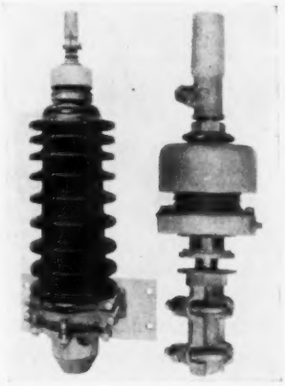
Groundem, Type GH. **Burndy Engineering Co., Inc.,** New York, N. Y.

stalled with a wrench and made in three sizes, each of which will take a range of rod and wire diameters.

Non-corrosive copper alloys are used to make the connector resistant to underground conditions.

Cable Terminator

Equipped at the lower end with a standard wiping sleeve and at the top with an expansion type stud, this single-conductor cable terminator is for use on an oil pressure cable. Expansion member is an oil-tight bronze bellows securely gasketed to the external parts and permits free expansion and contraction of the cable under



Terminator pictured on left, details of construction on right. **Delta-Star Electric Co.,** Chicago, Ill.

all weather and load conditions. Gas relief plug is also provided. Terminators can be furnished complete with internal barriers and stress cones to suit any style of cable, manufacturer states.

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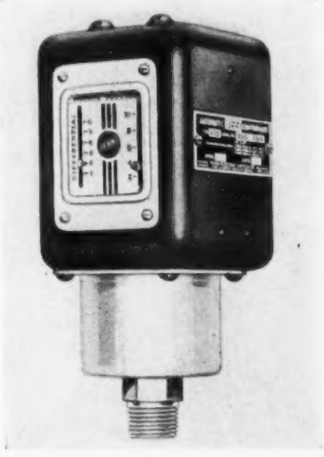
Boiler Controls

Recently announced pressure and temperature controls are available for use as limit switches (close low, open high) or operating controls on steam, hot water or vapor systems, or for unit heater and water circulator applications (close high, open low). They incorporate new "Magneseal" contact



"Series 400;" rated to include ½ hp., 110-220 volts a.c., and for 10 amp., 110 volts a.c., non-inductive, or 5 amp., 220 volts a.c., non-inductive service. **Penn Electric Switch Co.,** Des Moines, Iowa.

structures, a completely inclosed, dust- and tamper-proof, snap-acting, permanent-magnet type contact unit, said to eliminate all internal wiring and pigtails. De luxe models have adjustable range and differential, calibrated scale showing both settings; standard models have outside adjustable range, but fixed differential, no calibrated scale.

News Issue

ELECTRICAL WORLD

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